

# Pain in Nursing Homes Residents With and Without Cognitive Impairment. Results From Five Consecutive Multicenter Cross-sectional Surveys Carried Out Between 2014 and 2018 in Germany

**Rainer Centmayer**

Zentrum Ueberleben

**Manfred Leiske**

Freie Universitat Berlin

**Nils Axel Lahmann** (✉ [nils.lahmann@charite.de](mailto:nils.lahmann@charite.de))

PD Dr. Nils A. Lahmann geriatrics research group Charité - Universitätsmedizin Berlin Charitéplatz 1 D-10117 Berlin <https://orcid.org/0000-0002-6934-5387>

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## Research article

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# Abstract

**Background:** There is evidence that knowledge about the prevalence of pain and quality of pain management particularly in nursing home residents (NHR) with severe cognitive impairment (CI) is poor.

**Methods:** The multicenter cross-sectional surveys explored the prevalence of pain of NHR with or without CI from nursing homes in Germany. Actual pain intensity in rest and stress were documented. NHR were asked about their daily restrictions due to pain. Data about the pain management were collected and analyzed.

**Results:** A total of 3437 residents were interviewed with respect to feeling pain, including one third each with mild and severe CI. The prevalence of actual pain was 31,8%. Women reported pain more often. Prevalence of NHR without CI or with self-report on pain was significantly higher than NHR with severe CI or with external report on pain. About 20% of all NHR were dependent on external pain-recording. Nearly 10% of all NHR with pain confirmed pain in stress above 5 on a scale of 0 - 10. 85% of all NHR with pain reported that they had pain for longer than 3 months. Residents with severe CI are 0.55 times less likely to take painkillers than NHR without CI.

**Conclusion:** The study points out a significant deficit in pain management in German NHR with severe CI. Intensive training in pain management for employees in nursing homes is recommended.

## Background

Pain influences everyday life activities of the elderly, especially their mobility [1]. But mobility seems to be the key predictor for many health conditions in the context of care dependency in the nursing home setting [2]. Social contacts are limited and well-being and life satisfaction decrease when people experience chronic pain [3, 4, 5]. Moreover, pain is an emotional pressure for those suffering as well as a financial burden for the society [6]. It's difficult to measure pain. Apart from the subjective perception of those affected, the prevalence rates vary widely depending on the type of survey [7]. An additional challenge is the recording of pain in very old people and in people with severe CI. Pain management is very important in this vulnerable population because: "inability to communicate does not negate the possibility that a human [...] experiences pain." [8]. People with severe CI are additionally in risk to receive worse pain-relieving management than people self-reporting on pain [9]. A key role in pain-relieving management plays the nursing staff [10]. They still lack knowledge on pain and possible measurement tools [11, 12]. Furthermore there is limited evidence about the reliability and validity of pain assessments regarding people with CI [13]. That is why there are differences in pain assessments, even depending on the staff qualification [7]. There is also evidence that a systematic pain-assessment of care dependent people is insufficient [14].

The aim of this study is to establish the differences of NHR with pain in Germany with respect to gender and age between those who can report on experiencing pain and those who are not able of doing that. The research questions which are posed are:

What is the ratio of pain prevalence among NHR in Germany? Are there differences between self and external perceptions of pain, taking into account CI? What pain intensities at rest and stress do NHR report and to what extent are they restricted by pain in the activities of their lives? Does CI of NHR affect the quality of pain treatment?

## Methods

### Study design

The present study relies on data collected in the course of an annual representative, multi-center cross-sectional survey carried out by the Department of Nursing Science at Charité between 2014 and 2018.

### Setting

The research agenda did not aim at investigating a minimum number of participants. The representative character of the results from the prevalence survey of the previous year could be repeatedly proved and therefore a solid representative data state for the period between 2014 and 2018 was demonstrated [15]. The quantity of refusals and the number of participants who for some reason did not take part in the study was also recorded.

### Participants

The random samples were drawn from the residents of the participating nursing homes at that time. All NHR were asked to take part in the study. An informed consent by the residents or their legal representative was required [16, 17]. The participation was not mandatory but there was only one condition, namely that subjects should be over 16 years.

### Variables

Demographic variables like age and gender were raised. Furthermore, the NHR were asked about their actual pain. With this question it should be avoided that pain values of the last days or weeks were collected. In case a resident was not capable of providing this information, the nursing staff was asked to estimate the pain intensity at rest and stress and its implications for the daily life.

Both sources of information were recorded, independently of whether given by the NHR or the nursing staff. The NHR in the study were also classified according to their cognitive status, namely as having none, mild or severe CI by clinical judgement. The pain intensities at rest and stress conditions were asked by means of a visual analog scale. The scale served as subjective measuring the pain intensity of the NHR. The two end points (0–10) show the range of pain intensity (0 - no pain, 10 the strongest feeling of pain). The German Nursing Expert Standard on Pain and Interdisciplinary Medical Guidelines recommend that treatment should be adjusted to reduce subjective pain to a value of "3" (to 10) for pain at rest and to "5" (to 10) for pain at stress, unless a different target has been agreed with the patient [18, 19]. A cumulative score was calculated from the data on pain intensity at rest and stress as a confounder variable for multivariate analyses. The impairment grade due to pain in the daily life was also measured

through a graded scale from 0 (no impairment) till 10 (full impairment). The duration of pain was determined by means of the question "How long have you had pain?" with the answer options "acute", "1–3 months", "3–6 months" ">6 months". When determining the frequency of daily pain recording, it was asked whether pain was recorded up to twice a day or more often.

## Data Collection

Each nursing home had an employee responsible for the study. As a direct personal assessment, the data collection was carried out by nursing staff of the participating institutions. The training followed with specialized and standardized research instructions. These were up-to-date materials containing internationally standardized research definitions and expressions. The research team could be contacted by telephone at any time. The data collected were registered in machine-readable questionnaires and forwarded to the assessment institution. The questionnaires were scanned and the information was transferred to the statistics program SPSS.

## Data analysis

The evaluation of the data took place by the program IBM SPSS 24.0. The evaluation included apart from table and graphic processing of the frequency distribution, also common characteristics regarding the central tendency, dispersion and distribution. Contingency table analyses were used to compare the percentage distributions of the binary target variables differentiated by grouping variables. The inferential statistical test for independence was carried out using chi-square tests ( $\chi^2$ ). To test a possible confounding, binary logistic regression analyses were calculated for a multivariate analysis of the binary target variables.

The inferential statistical testing of the distribution of (quasi-)metric variables for differences in group comparisons with regard to central tendencies was carried out with the Mann-Whitney-U-Test ('MWU'-Test) in two comparison groups and with the Kruskal-Wallis test ('H' test) in more than two comparison groups, together with a post-hoc analysis using the Dunn-Bonferroni test ('DB' test) to determine which groups differ significantly. Spearman correlation coefficients were calculated for the description and inferential statistical testing of the correlation of (quasi-)metric variables. All tests were 2-sided, the significance level was set at  $p < 0.05$ .

## Results

3483 NHR participated in the surveys from 2014 to 2018. Most of the residents were female (70.7%). The average age was 81.7 (+/-11.9).

### Pain prevalence

Information on pain was available for 3437 NHR. The results of the study show that 31.8% of the NHR were affected by actual pain at the time of the survey. Table 1 shows the overall distribution of the pain prevalence classified by gender, age, cognitive impairment and the way in which the pain was reported.

Table 1  
Pain prevalence classified by gender, age, CI and pain report

		NHR with pain		all NHR	
		n	% in rows	n	%
		1093	31.8	3437	100
<b>gender</b>					
$\chi^2_{df=1} = 18.15$ p < 0.05	female	798	34.1	2339	61.1
	male	260	26.6	979	28.5
<b>age</b>					
$\chi^2_{df=3} = 40.78$ p < 0.05	< 70a	90	19.8	454	13.2
	< 80a	182	29.4	619	18.8
	< 90a	512	34.6	1479	43.0
	> 90a	301	34.8	864	25.1
<b>CI</b>					
$\chi^2_{df=2} = 46.95$ p < 0.05	no	204	40.4	505	14.7
	mild	382	34.0	1122	32.6
	severe	303	24.9	1219	35.5
<b>pain report</b>					
$\chi^2_{df=1} = 9.02$ p < 0.05	self	789	39.3	2008	58.4
	external	224	32.8	682	19.8

A comparative analysis of pain prevalence differentiated by gender, age group, degree of CI and type of pain report revealed significant differences. Pain prevalence was higher in women (34.1%) than in men (26.6%). Higher pain prevalence rates of 34.6% and 34.8% were observed in the higher age groups compared to the younger age groups (19.8% and 29.4%). Significantly lower pain prevalence rates were found for higher levels of CI. While 40.4% of NHR without CI reported pain, the proportion of NHR with severe CI was 24.9%. Pain reports was provided by 58.4% of the NHR themselves, while 19.8% of the NHR provided this information as a result of an external evaluation. At 39.3%, the proportion of persons affected by pain was significantly higher in the group of NHR who were able to give information than in the group of NHR who were unable to provide information (32.8%).

Table 2 shows the result of the logistic regression of pain prevalence, taking into account the variables gender, age, degree of CI and the way in which pain data are determined as influencing variables.

Table 2  
Logistic regression of pain prevalence (n = 2231)

		coefficient of regression B	significant p	Odd Ratio OR	OR 95%- confidence interval
<b>gender</b>		0.337	0.002	1.401	1.136–1.728
<i>m = 1 / f = 2</i>					
<b>age</b>		0.031	0.000	1.032	1.023–1.041
<b>CI</b>	no	(refer. categ.)	0.000		
	mild	-0.398	0.001	0.672	0.527–0.855
	severe	-0.690	0.000	0.502	0.387–0.650
<b>pain report</b>		-0.107	0.360	0.899	0.715–1.129
pat.=1 / carer = 2					

Hosmer-Lemeshow-Test:  $\chi^2_{df=8}=10.436; p = 0.236$

With the exception of the variable "pain report", the predictors have a significant influence on the pain prevalence. The variable "CI" has the strongest influence on pain prevalence with an odds ratio of 0.67 and 0.50. This means compared to persons without CI, there exists the relative likelihood of having pain decreases by 32.8% for persons with "mild" CI and by 49.8% for persons with "severe" CI. Gender influenced the pain prevalence with an odds ratio of 1.4. Women reported pain 1.4 times more often than men. The Hosmer-Lemeshow test for goodness-of-fit shows that the model is suitable to adequately represent the data.

#### Pain intensity and pain duration

Mild pain at rest (value 1–3) was found in 53.8%, acceptable pain at stress (value 1–5) had 88.5% of all NHR with actual pain. Moderate to excruciating pain at rest (value > 3) was experienced by 10.0% of the NHR, and 10.8% (value > 5) at stress. 5.7% of all NHR with pain had moderate to excruciating pain at rest (> 3) as well as at stress (> 5). Details on this will be found in Supplement, Fig. 1. On average, the intensity of pain at rest was 1.5 (+/-1.6), the average intensity of pain at stress 3.2 (+/-1.8). The inferential statistical tests show that the distribution of pain intensity at rest differed significantly according to the degree of CI and the type of pain report. A higher degree of CI corresponded to a lower pain intensity at rest ('H' test:  $\chi^2_{df=2} = 18.93; p < 0.05$ ). Post-hoc tests (Dunn-Bonferroni tests) showed that the pain-at-rest-intensity of NHR with 'severe' CI differed significantly from NHR with 'mild' CI ( $z = 4.01, p < 0.05$ ) and 'no' CI ( $z = 3.41, p < 0.05$ ).

A lower pain intensity was found in NHR whose pain intensity was calculated by the nursing staff compared to NHR who reported information themselves (MWU test:  $U = -2.303$ ,  $p < 0.05$ ). Differentiated by gender and age groups, no significant differences in the distribution of pain intensity at rest and stress were found. The distributions of pain intensity at stress, differentiated according to the degree of CI and the type of pain report, also showed no significant differences. Information on the duration of existing pain was available from 919 NHR. Details on this will be found in Supplement, Fig. 2, where 85.4% of NHR affected by actual pain were found to have been in pain for more than three months and 56.9% for more than six months.

### Impairment of everyday life through pain

10.4% of all NHR with actual pain did not report any impairment of their daily life or were also externally assessed. A moderate to severe impairment of everyday life through pain (value  $> 3$ ) was present in 25.6% of the NHR. On average, the impairment of everyday life related to pain was 2.6 ( $\pm 2.0$ ). Details can be found in supplement, Fig. 3. The results of the inferential statistical test (MWU test) show significant differences only in the distribution of pain-related impairment of everyday life, differentiated by type of pain report. In the case of externally assessed NHR, significantly lower pain-related impairments of everyday life were documented in comparison to NHR who were able to provide information (MWU Test:  $U = -2.06$ ,  $p < 0.05$ ). Differentiated by gender, age groups and degree of CI, no significant differences in pain-related impairment of everyday life were found. The degree of pain-related impairment of everyday life correlated significantly with pain intensity at rest ( $r_s = 0.56$ ;  $p < 0.05$ ;  $n = 996$ ) and pain intensity at stress ( $r_s = 0.78$ ;  $p < 0.05$ ;  $n = 996$ ). According to the classification by Cohen [20], both of these correlations are strong effects. The higher the intensity of pain in rest or stress, the higher the degree of pain-related impairment of everyday life. The significance test according to Meng et. al. [21] showed that the two correlation coefficients differ significantly ( $z = 11.49$ ;  $p < 0.05$ ). This means, that the degree of pain-related impairment of everyday life correlates significantly higher with pain intensity at stress than at rest.

### Pain management

In 22.8% of all NHR with actual pain, pain was recorded more than twice a day and 82.1% confirmed the use of painkiller. Table 3 shows the results for the use of painkiller and the frequency of pain recording more than twice a day, differentiated by gender, age, cognitive impairment and type of pain recording.

Table 3

Intake of painkillers and frequency of daily pain assessment differentiated by gender, age, CI and type of pain report

		Taking painkillers				Frequency of daily pain recording			
		yes		no		≤ 2 times		> 2 times	
		n	%	n	%	n	%	n	%
<b>total</b>		837	82.1	182	17.9	784	77.2	232	22.8
<b>gender</b>	female	622	83.6	57	23.3	577	78.2	161	21.8
	male	188	76.7	122	16.4	189	77.5	55	22.5
		$\chi^2_{df=1} = 5.86; p < 0.05$				$\chi^2_{df=1} = 0.06; p > 0.05$			
<b>age</b>	< 70a	71	81.6	16	18.4	66	79.5	17	20.5
	< 79a	138	84.1	26	15.9	120	71.9	47	28.1
	< 89a	388	81.2	90	18.8	369	78.3	102	21.7
	> 89a	234	82.7	49	17.3	223	77.7	64	22.3
		$\chi^2_{df=3} = 0.83; p > 0.05$				$\chi^2_{df=3} = 3.35; p > 0.05$			
<b>CI</b>	no	167	87.0	25	13.0	140	73.3	51	26.7
	mild	295	81.5	67	18.5	283	78.4	78	21.6
	severe	225	78.7	61	21.3	234	82.1	51	17.9
		$\chi^2_{df=2} = 6.36; p < 0.05$				$\chi^2_{df=2} = 6.25; p < 0.05$			
<b>pain reporting</b>	self	626	83.6	123	16.4	562	76.4	174	23.6
	external	165	77.8	47	22.2	169	82.0	37	18.0
		$\chi^2_{df=1} = 3.84; p < 0.05$				$\chi^2_{df=1} = 2.99; p > 0.05$			

The use of painkiller was significantly more frequent in women (83.6%) than in men (76.7%). The proportion of NHR taking pain medication was significantly higher among NHR without CI compared to NHR with CI. At 83.6%, the proportion of NHR who took painkiller was significantly higher among those who were able to report about their pain than those who were unable to do so. There were no significant differences between the age groups. The proportion of NHR who had pain assessment more than twice a day was significantly higher in residents without CI (26.7%) compared to NHR with mild or severe CI. Differences in NHR with pain assessment more than twice a day indicated by gender, age group and type of pain report are not significant. Table 4 shows the logistic regression of the dependent variable ,taking a painkiller' and Table 5 the logistic regression of the dependent variable ,frequency of daily pain recording',

taking into account the variables gender, age, CI and the summscore of painintensity at rest and stress as influencing variables

Table 4  
Logistic regression of the dependent variable 'taking a painkiller' (n = 780; yes = 1/ no = 0)

	regression-coefficient B	significance p	Odd Ratio OR	OR 95%-confidence intervall	
<b>gender</b> m = 1 / f = 2	0.493	0.025	1.637	1.064–2.518	
<b>age</b>	-0.006	0.518	0.994	0.978–1.013	
<b>painintensity</b> (summscore rest + stress)	0.289	0.000	1.335	1.221–1.459	
<b>CI</b>	No (refer. cat.)	0.076			
	mild	0.487	0.066	0.614	0.978–1.013
	severe	0.605	0.026	0.546	0.320–0.930

Hosmer – Lemeshow - Test:  $\chi^2_{df=8} = 9.928$ ; p = 0.270

Table 5

Logistic regression of the dependent variable 'frequency of daily pain recording' (n = 772; > 2 daily = 1/ ≤ 2 daily = 0)

		regression coefficient B	signifikance p	Odd Ratio OR	OR 95%- confidence intervall
<b>gender</b>		-0.174	0.423	0.840	0.549–1.286
m = 1 / f = 2					
<b>age</b>		-0.007	0.459	0.993	0.973–1.012
<b>painintensity</b>		0.108	0.000	1.114	1.055–1.176
(summscore rest + stress)					
<b>CI</b>	No	(refer. cat.)	0.037		
	mild	-0.289	0.191	0.749	0.486–1.155
	severe	-0.629	0.010	0.533	0.329–0.862

Hosmer-Lemeshow-Test:  $\chi^2_{df=8}=10.793$ ; p = 0.214

The results of the logistic regression models show that the intensity of pain and the degree of CI significantly influence the intake of a painkiller as well as the frequency of daily pain recording. Increasing the pain intensity score by one unit increased the relative probability of taking a painkiller by 33.5% and of recording pain more than three times a day by 11.4%. At constant pain intensities compared to NHR without CI, for NHR with "severe" CI the relative probability of taking a painkiller decreased by 45.4% and pain recording more than three times a day by 46.7%. There were significant differences between women and men with regard to the use of pain medication. The relative probability of taking a painkiller was 63.7% higher for women than for men. The Hosmer-Lemeshow-Test as a test for the goodness of fit, show that both models are suitable for adequately representing the data.

## Discussion

The examined NHR resembled the general NHR in Germany in terms of age and gender [22]. Overall, almost a third of all NHR of this survey reported actual pain. The multivariate statistical analysis of the data shows gender, age and degree of CI as independent aspects that influence the pain prevalence rate. It should be noted that women reported pain more frequently than men and that the frequency of pain increases with age. Similar to the results in many studies, the prevalence of pain in NHR with CI is lower than of NHR without CI [23–26]. This study also shows that the decisive factor for the lower pain prevalence rate is the diagnosis "severe" CI, regardless of age, gender and the method of pain report. In this survey, the pain prevalence rates of self-reporters on actual pain are similar to comparable settings.

Between 27.8% and 46% were measured in international comparison [27]. 20% of the NHR in this survey were not able to provide information on pain so the nursing staff had to do an evaluation of the pain.

However, the lower pain prevalence in NHR with CI compared to cognitively capable NHR is not based on the different ways in which pain is assessed (self-report or external-report). These findings suggest that pain management in NHR with CI is a key challenge for both, responding and nonresponding NHR [28]. In particular, it is considerably more difficult to describe the experience of pain in older people with severe CI, e.g. dementia [29].

The results show that about 10% of NHR with actual pain suffered from moderate to severe pain. In more than half of all NHR with pain, the pain existing had lasted for more than 6 months. For about ¼ of all NHR with actual pain, a moderate to severe impairment of their everyday life was the result, which was caused to a greater extent by lack of activities. Pain sensations and impairment in everyday life were significantly lower in NHR with CI or external report. These results can suggest that disoriented NHR have poor skills to express their pain. It can also be assumed that pain in this vulnerable group is insufficiently recognized or underestimated, with the risk that the NHR pain expressions will not be used to draw consistent conclusions about appropriate pain therapy as part of a systematic pain management. However for NHR in the context of care that promotes resources and autonomy, systematic pain management is an elementary contribution to the quality of care. NHR with pain have a higher need of care than patients without pain [30]. If pain is not properly monitored and treated, there is an additional risk of pain-related impairment of everyday life. Using the frequency of daily pain assessment and administration of painkillers as indicators for pain management, the study indicates that pain management for NHR with severe CI is inadequately compared to NHR without CI. While the probability of recording pain several times a day and taking a painkiller increases with increasing pain intensity, NHR with severe CI are less likely to take these interventions compared to patients without CI - regardless of the degree of pain intensity. These results suggest that NHR with severe CI are at risk of being undertreated.

## Limitations

Pain was one of up to eight survey dimensions in the annual survey on nursing problems in Germany. Thus, pain could not be recorded in its complexity. The representativeness of a sampled prevalence survey is always limited. Contexts can be presented, but no conclusive explanations of causes and effects can be given. The study design required 1:1 interviews for the data collection. However, the study management cannot rule out the possibility that data from the written documentation were also used in isolated cases. The percentage of non-participants may influence the results of the examination and lead to minor shifts. It cannot be excluded, for example that the proportion of NHR with severe CI in particular could be even higher, or that people with significant care problems were specifically excluded by relatives or the local study coordinators. In comparison with data from the Medical Advisory Service of the German Association of Statutory Health Insurance funds, however, there is only a slight difference in the prevalence rates for pain [31].

# Conclusions

Lower pain prevalence rates among NHR with CI should be taken as an indicator that the collection and analysis of pain data is a sensitive area of concern. There is a potential risk of insufficient initiatives being taken to reduce potential pain. In Germany, an important step was taken with the development of the German expert standards on acute and chronic pain [19, 33]. These contain essential recommendations for pain management in nursing. The results of the present study indicate that pain by numerous NHR with CI is insufficiently recognized or insufficient measures for pain reduction are initiated. Further studies are needed to address the specific needs of NHR with severe CI. This demand is reinforced by the frequency of coexistence of pain and dementia and the difficulty of pain recognition [34–36]. Finally, NHR with severe and moderate CI also have the right to smart pain management [37, 38]. Effective pain management helps to reduce aggression and agitation as well as promotes mobility in NHR [39]. Nonetheless, it remains important to record individual pain levels of NHR at rest and stress regularly, sometimes several times a day, especially during drug therapy. When pain medication is administered, the efficacy must be investigated and documented. Continuous training on pain for nursing staff is strongly recommended [40].

# Abbreviations

NHR: nursing home residents

CI: cognitive impairment

refer. categ.: reference category

m: men

f: female

# Declarations

Ethics approval and consent to participate

Informed consent was obtained from study participants. Verbal informed consent was considered sufficient to (1) reduce bureaucratic burden and (2) increase participation. Informed consent had to be given in front of a testifying second person of staff. This procedure was approved by the ethics committee of the Charité-Universitätsmedizin Berlin Eth-837-262/00

Consent for publication

All authors have read and agreed to the published version of the manuscript and provide consent for publication

## Competing interests

All Authors declare that they have no financial or personal relationship that influence (bias) their work and have therefore no competing interests to declare.

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## Author Contributions:

Conceptualization: R.C., M.L., N.A.L.; methodology: N.A.L., M.L.; analysis: M.L., N.A.L., R.C.; writing—original draft preparation: R.C., M.L.; supervision: N.A.L.

All authors have read and approved the manuscript.

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## Availability of Data and Materials:

The analyzed data for this manuscript can be retrieved on demand from the corresponding author.

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