

## Original Experimental

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# Pharmacological treatment of pain in Swedish nursing homes: Prevalence and associations with cognitive impairment and depressive mood

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### Abstract

**Objectives** – Chronic pain is highly prevalent in nursing home residents and often occurs with depression as well as cognitive impairment, which can severely influence and limit the expression of pain.

**Methods** – The present cross-sectional study aimed to estimate the prevalence of pain, depressive mood, and cognitive impairment in association with pharmacological treatment against pain and depressive symptoms among Swedish nursing home residents.

**Results** – We found an overall pain prevalence of 52.8%, a prevalence of 63.1% for being in a depressive mood, and a prevalence of cognitive impairment of 68.3%. Among individuals assessed to have depressive mood, 60.5% were also assessed to have pain. The prevalence of pharmacological treatment for pain was 77.5 and 54.1% for antidepressants. Prescription of pharmacological treatment against pain was associated with reports of currently having pain, and paracetamol

was the most prescribed drug. A higher cognitive function was associated with more filled prescriptions of drugs for neuropathic pain, paracetamol, and nonsteroidal anti-inflammatory drugs (NSAIDs), which could indicate an undertreatment of pain in those cognitively impaired.

**Conclusion** – It is important to further explore the relationship between pain, depressive mood, and cognitive impairment in regard to pain management in nursing home residents.

**Keywords:** pain, pain management, elderly, depression, cross-sectional studies, prevalence

## 1 Introduction

Chronic or prolonged pain is a worldwide public health problem affecting 20% of the population in Europe [1]. While the prevalence of chronic pain is generally much higher among older persons, nursing home residents are reported to have the highest prevalence of chronic pain overall with numbers ranging from 48 to 80% [2,3]. The variance of reported pain prevalence can partly be explained by the variation of sources for pain information [4]. Nevertheless, these numbers are expected to increase as the population of older adults ( $\geq 65$  years) in Europe is estimated to rise from 90.5 million at the start of 2019 to 129.8 million by 2050, which warrants increased attention to this group and their pain management [5].

Among nursing home residents, little is known about the prevalence of different chronic pain types and the classification used to identify these is somewhat unclear, and above all inconsistent [6]. Utilizing the 11th International Statistical Classification of Diseases and Related Health Problems (ICD) classification for pain, a recent study in Norwegian nursing home residents with major neurocognitive disorder (NCD) reported that among the residents with pain, the most common pain diagnosis by far was musculoskeletal pain (whether primary or

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secondary) followed by chronic widespread pain as primary- and chronic neuropathic pain as secondary pain syndrome [6].

Co-morbidities alongside pain are common and depression is the most frequently reported. The literature states depression to be present in as much as 13% of pain cases among the older population [7]. There is also the possibility of co-occurring major NCD, which can influence not only the expression of pain but also severely limit the ability to communicate their pain [8]. Pain can lead to a manifestation of symptoms related to depression and, in turn, depression can be difficult to distinguish from the onset of mild cognitive impairment as both conditions include symptoms that can overlap [7]. A study by Tosato and colleagues showed an association between pain, behavioral, and psychiatric symptoms such as inappropriate behavior, abnormal thought processes, resistance to care, and delusions among nursing home residents with cognitive impairment [9]. Chronic pain has also been associated with lower quality of life (QoL) among people 65 years and older [10].

Pharmacological treatment in older persons can be particularly challenging due to the pharmacodynamic and pharmacokinetic changes caused by aging that result in altered drug metabolism [11]. A basic rule of any chronic pain treatment is continuous evaluation of the treatment effect and possible adverse effects [12]. Among the currently recommended medications for the treatment of chronic pain, there are a number of medications that are inappropriate for older adults due to metabolic changes.

The National Board of Health and Welfare in Sweden has composed a list of medications that should be avoided in older persons due to an increased risk of side effects. This list includes the pain treatment substances tramadol and codeine but also substances related to pain treatment that are often prescribed to older adults without re-assessment of their effects. These medications include nonsteroidal anti-inflammatory drugs (NSAIDs), opioids, and paracetamol [13].

However, an increased focus on re-assessment and careful consideration of pharmacological treatment for older adults should not be translated into undertreatment of pain. It has been previously shown that persons with pain could be subjected to a considerable under-treatment, particularly for those with cognitive impairment, and it has also been stated that treating pain with, e.g., opioids among nursing home residents with major NCD is related to an increase in social interactions and an overall improvement of activities of daily living (ADL) while showing no impact on their cognitive function [14,15].

This study aims to estimate the prevalence of pain among nursing home residents in Sweden, along with the occurrence of cognitive impairment and a depressive mood.

Moreover, we aim to assess the prevalence of pharmacological treatment related to pain and depression, and the association between these prescribed medications and sex, age, cognitive impairment, assessment of pain, depressive mood, ADL, and QoL.

## 2 Methods

### 2.1 Data

This study combined the results from the Swedish National Inventory of Care and Health in Residential Ages Care (SWENIS) survey together with individual data from the Swedish Prescribed Drug Register through Swedish personal identity numbers in a cross-sectional study design. SWENIS has a longitudinal design with a repeated point of prevalence measurement every 5 years. SWENIS baseline data were collected in 2014 and the first 5-year follow-up was performed in 2019. The SWENIS follow-up survey was sent to a nationally representative sample of nursing homes in Sweden, following a randomization procedure. In total, 315 nursing homes were contacted in 43 municipalities and 235 nursing homes agreed to participate. A total of 7,073 surveys were sent to these 235 nursing homes, and 3,894 surveys were returned from 187 nursing homes (55%). Forty percent of the 2,883 surveys included the complete personal identity numbers required to link survey responses to the register data for this study. The primary carers were engaged as proxies for all residents to ensure that data from residents with major NCD or cognitive impairment could be included.

In addition, data from the Swedish National Prescribed Drug Register of filled prescriptions for pain-related medications were received and applied to the sample. A description of the included variables and their modification in terms of dichotomization is described in more detail below.

### 2.2 Selected sample

Our sample comprises of nursing home residents included in the 5-year follow-up of the SWENIS survey, and who were assessed for questions regarding cognitive impairment. The data included were selected during the following two steps: first cases were selected on the basis of whether their personal identity number was correctly reported in the survey since this is a requirement for linking survey

answers to register data and, second, whether there were available data on the survey question “Does the person experience pain?” and for the dichotomized variable of Gottfries rating scale for determining symptoms of major cognitive disorder (defined below).

Additionally, after the addition of data from the Swedish National Prescribed Drug Register, the sample was further selected to include only individuals who were alive between January 01, 2019, and June 30, 2019 (the time period of data extracted from the register). Altogether, these selections resulted in a final sample of 2,401 residents for this present study.

## 2.3 Independent variables

### 2.3.1 Pain

The question “Does the person experience pain?” in the survey was used to indicate whether the enrolled resident was experiencing pain or not.

### 2.3.2 Depressive mood

A question in the survey inquired whether the residents were assessed to be in a depressive mood or not. Three different levels of the depressive mood were defined: mild depressive mood was described as “somewhat depressed but possible to be diverted,” moderate depressive mood as “a heavy mind, gloomy, can be diverted briefly,” and “a very heavy mind, miserable, not possible to be diverted” was defined as severe depressive mood. A dichotomized variable was computed where the no depressive mood (code 0) and all three levels of depressive mood were recoded into one, thus representing all levels of assessed depressive mood (code 1). This dichotomized variable was used for the regression analysis.

### 2.3.3 The Gottfries cognitive scale (GCS)

The GCS has previously been validated for proxy use by staff in nursing homes [16] and is commonly used to measure cognitive function [17]. In total, 27 items equal a total maximum score of 27, where a dichotomized variable defined by a cut-off value of  $\geq 24$  was created indicating whether the resident is suffering from cognitive impairment ( $< 24$ ) (code 1) or not ( $24-27$ ) (code 0). In the multiple regression analysis, the scale has been used as a continuous variable.

### 2.3.4 The Katz index of independence in ADL (Katz-ADL)

Activity function among residents was assessed using the Katz-ADL instrument wherein six statements are assessed by proxy staff based on the residents’ level of dependence or independence in regard to daily activities of bathing, transferring, toileting, continence, dressing, and eating [18]. Scores range between 0 and 6, where 0 represents full dependence and 6 full independence. Thus, a higher score indicates a greater level of independence. A dichotomized variable was computed and used for the logistic regression analysis, defining a score between 0 and 3 as more dependent (code 0) and between 4 and 6 as more independent (code 1) and thus requiring help performing less than three daily activities.

### 2.3.5 QoL

A visual analogue scale, part of the EQ-5D health evaluation, ranging from 0 to 100 (where 0 was defined as the worst possible health and 100 was defined as the best possible), was used to assess general QoL among the residents [19].

## 2.4 Dependent variables

Reported drug use is defined as one or more filled prescriptions within the selected 6-month period. Dichotomized variables were created for all drug classes wherein missing values and no filled prescription for any drugs belonging to the respective ATC code were defined as not filled (code 0) and a filled prescription to any of the drugs belonging to the ATC code was defined as filled (code 1).

Drugs included in this present study were recommended drugs from clinical guidelines for the treatment of pain and depressive symptoms, wherein the following ATC groups/variables were created NSAIDs + glucosamine (M01), opioid analgesics (N02A), paracetamol (N02BE), common treatments of neuropathic pain (N02BF, N06AA, N06AX), and selected drugs commonly used to treat depression (N06) (Table S1 (Supplementary Material) for a full list of included drugs). Pharmacological treatment for pain was thus defined as enrolled residents having filled at least one prescribed prescription within the included ATC drug categories.

## 2.5 Statistical analysis

For statistical analyses, SPSS version 28 and Graph Pad Prism 9 were used. The significance level was set to  $p < 0.01$

to compensate for multiple comparisons. Descriptive statistics was used to assess demographic characteristics within the sample. Chi-square tests were used for comparisons between two groups of binominal categorical variables. Multiple logistic regression was used for the assessment of associations between the different ATC groups (dependent variables, dichotomized) and the independent variables of age (continuous), sex (categorical), cognitive impairment (continuous), ADL score (dichotomized), QoL (continuous), and depressive mood (dichotomized).

## 3 Results

### 3.1 Demographic data

Demographic data from the SWENIS population included in this study can be found in full in Table 1. The final sample of 2,401 residents was in majority female (65.3%) and the mean age among residents was 85, ranging from 49 to 106 years of age.

The Swedish unit dose dispensing system was used by 88.7% of residents. ADL utilizing the Katz ADL scale was estimated at a mean of 3.1(±2.2) and the fraction of residents categorized as “dependent” was estimated at 46.4%, meaning they need help performing at least 3 daily activities. Lastly, the QoL for enrolled residents stated by their proxies had a mean of 62.8 (±23.3) and a median of 70.

### 3.2 Pain and cognitive impairment

Pain prevalence was estimated at 52.8% within our sample (Table 1). Average cognitive function was estimated to be 17.4 (±8.1) using the GCS, wherein 68.1% of residents qualified as cognitively impaired (scoring below 24). No differences were found regarding co-occurrence of pain in residents with or without cognitive impairment. About half of the enrolled residents who were assessed to have cognitive impairment also experienced pain (51.6%) and vice versa (55.4%) (Figure S1, Supplementary Material) ( $\chi^2(1) = 3.011$ ,  $p = 0.083$  phi coefficient,  $\Phi = 0.35$ ).

### 3.3 Pain and depressive mood

Overall proxy reports of depressive mood were summarized to 63.1%, where mild depressive mood was most frequently reported (42.6%), moderate depressive mood was assessed to be present in 18% of residents, and 2.5% of residents were assessed as having a severe depressive mood, resulting in roughly one-third of enrolled residents (36.3%) not currently suffering from a depressive mood (Table 1). There was a statistically significant association found between residents experiencing pain and proxy reports of current depressive mood, where 60.5% of residents with reports of depression also had reports of pain ( $\chi^2(1) = 98.32$ ,  $p = 0.001$  phi coefficient,  $\Phi = -0.20$ ). Among

**Table 1:** Demographic data for nursing home residents included in the SWENIS survey

Gender, <i>n</i> (%)	Female	Male		
	1,569 (65.3)	822 (34.2)		
Age	Range	Mean age		
	49–106 years	85 years		
Pain, <i>n</i> (%)	Yes	No		
	1,267 (52.8)	1,134 (47.2)		
GCS, mean (SD)	17.4 (±8.1)			
Cognitive impairment, <i>n</i> (%)	Yes	No		
	1,635 (68.1)	766 (31.9)		
Depressive mood, <i>n</i> (%)	Not in depressive mood	Mild depressive mood	Moderate depressive mood	Severe depressive mood
	872 (36.3)	1,024 (42.6)	433 (18.0)	59 (2.5)
Katz ADL score, mean (SD)	3.1 (±2.2)			
Dependence in ADL, <i>n</i> (%)	1,049 (46.4)			
Quality of life, mean (SD)	62.8 (±23.3)			
DDS, <i>n</i> (%)	Yes	No		
	2,129 (88.7)	232 (9.7)		

Abbreviations: GCS: Gottfries cognitive scale; Katz ADL: Katz index of independence in activities of daily living; DDS: dose dispensing system; SD: standard deviation.

residents not reported to have a depressive mood, only 39.4% were reported to be in pain (Figure 1 and Table S2, Supplementary Material).

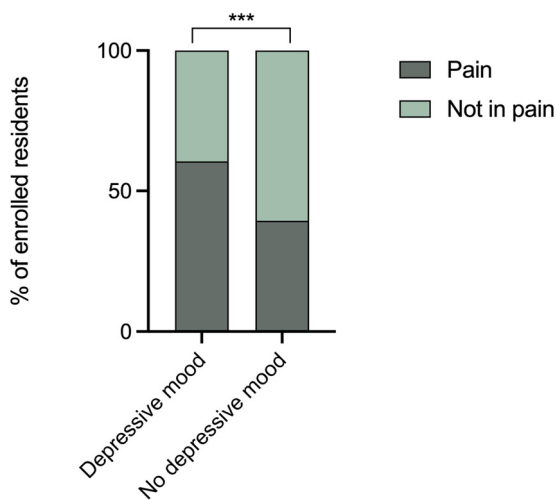
### 3.4 Prevalence of pharmacological treatment

In total, 3,719 prescriptions were filled within the studied timeframe among the selected medications in the study population (Table 2). For the specific pharmacological treatment areas highlighted in this article, 77.5% of the individuals filled at least one prescription for pain treatment, and 54.1% of the residents filled at least one prescription for antidepressants.

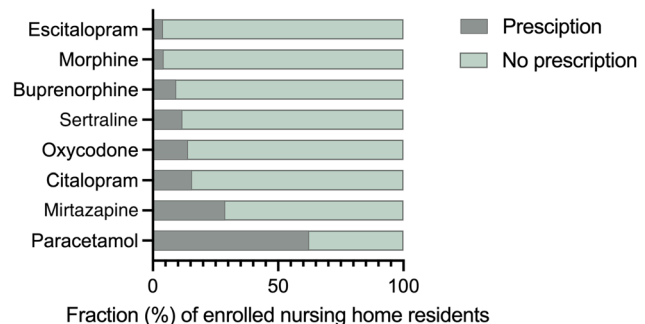
The most prevalent drug was paracetamol, of which 62.1% of residents had filled at least one prescription

(Table 2). Only 4.4% of residents were prescribed any drug belonging to the group NSAIDs including glucosamine (M01), and 27.7 % of residents were prescribed opioids. Drugs commonly used to treat neuropathic pain were prescribed to 6.6% of residents, and, finally, 54.1% of residents were prescribed antidepressants (Table 2). Figure 2 shows the most frequently prescribed individual substances among enrolled residents, where the subsequent (apart from paracetamol) most prescribed drugs were mirtazapine (28.9%) and citalopram (15.6%).

When summarizing the number of residents with filled prescriptions from the categories intended as treatment for pain into a new dichotomized variable (not including N06A), and combining these with the number of residents who through proxies were reported to experience pain or not, there was a statistically significant difference between these groups, where 11.8% of residents with reports of pain were not prescribed any pain medications, and 65.5% of residents who were reported not suffering from pain were prescribed drugs commonly used for pain treatment ( $\chi^2(1) = 175.73, p = 0.001$  phi coefficient,  $\Phi = -0.27$ ) (Figure 3, Table 3).



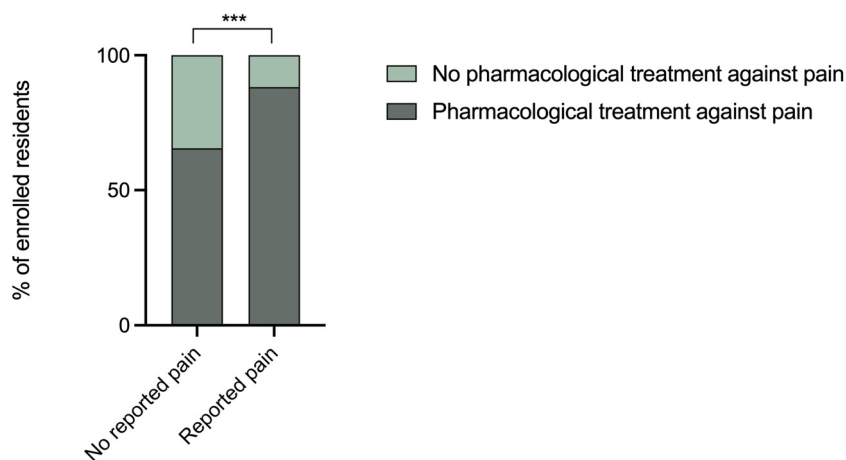
**Figure 1:** 60.5% of enrolled residents with depressive mood were assessed as having pain, while 39.4% of residents who did not have a depressive mood had pain. Chi-square test, asterisks indicate  $p < 0.001$ .



**Figure 2:** Most frequently prescribed (and filled) individual drugs (%) among enrolled nursing home residents.

**Table 2:** Number of filled ( $n$ ) and not filled ( $n$ ) including the percentage of prescriptions within ATC codes for anti-inflammatory medications, opioids, paracetamol, treatment for neuropathic pain, and antidepressants among enrolled nursing home residents

	Filled ( $n$ )	%	Not filled ( $n$ )	%
M01 (NSAIDs including glucosamine)	106	4.4	2,295	95.6
N02A (opioids)	664	27.7	1,737	72.3
N02BE (paracetamol)	1,491	62.1	910	37.9
N02BF, N06AA, N06AX (drugs related to neuropathic pain: gabapentin, pregabalin, amitriptyline, and duloxetine)	158	6.6	2,243	93.4
Pain treatment total	1,860	77.5	541	22.5
N06A (antidepressants)	1,300	54.1	1,101	45.9



**Figure 3:** Reports of pain in relation to filled prescriptions for drugs commonly used to treat pain. Among the residents with reported pain (through proxy), 88.2% of residents had filled prescriptions for pain treatment and thus 11.8% had reports of pain but no prescriptions for pain medication. Among the residents reported (through proxy) not being in pain, 65.5% of residents still had filled prescriptions of drugs commonly used to treat pain. Chi-square test, asterisks indicate  $p < 0.001$ .

### 3.5 Multiple logistic regression analysis

Each drug category was further investigated for possible associations with independent variables of depressive mood, pain, sex, age, cognitive impairment, and QoL. Please refer to Table 4 for data including all variables described below.

The presence of filled prescriptions of drugs related to pain management was all significantly associated with the presence of pain ( $p < 0.001$ ) while no significance was found between the presence of pain and drugs commonly used to treat depression (Figure 4).

Going through the associations found with each ATC drug category, apart from pain, a higher cognitive function was found to be associated with prescriptions of NSAIDs [odds ratio (OR) = 1.046, 95% confidence interval (CI) [1.013, 1.080]  $p = 0.006$ ]. There was a weak association between opioids and decreased QoL (OR = 0.994, 95% CI [0.989, 0.999]  $p = 0.011$ ). For paracetamol, further significant associations were found between treatment and increasing age (OR = 1.021, 95% CI [1.009, 1.033]  $p < 0.001$ ), higher cognitive function (OR = 1.020, 95% CI [1.006, 1.033]  $p = 0.004$ ), and lower ADL score (OR = 0.660, 95% CI [0.995, 1.004]  $p < 0.001$ ).

Drugs commonly used to treat neuropathic pain (N02BF, N06AA, N06AX) were significantly associated with having a

higher score on the GCS, indicating that it was more likely to be prescribed drugs from this category if the resident had a higher cognitive function (OR = 1.066, 95% CI [1.037, 1.095]  $p < 0.001$ ).

Drugs commonly used to treat depressive symptoms (N06A) were found to be associated with lower age (OR = 0.982, 95% CI [0.971, 0.993]  $p = 0.001$ ), and finally, there was a strong association between this drug category and reports of a depressive mood (OR = 2.205, 95% CI [1.815, 2.679]  $p < 0.001$ ).

## 4 Discussion

The aim of this study was to estimate the prevalence of pain among older adults living in nursing homes in Sweden in 2019, including the co-occurrence of depressive mood and cognitive impairment, respectively. Furthermore, the aim was to also assess the pharmacological treatment in regard to pain and depressive mood and explore associations between these treatments with sex, age, cognitive impairment, reports of pain, reports of a depressive mood, ADL, and QoL.

**Table 3:** Frequencies of filled prescriptions of drugs commonly used to treat pain among nursing home residents reported to experience pain or not

	Pain (n)	%	Not in pain (n)	%
Filled prescription(s) of treatment for pain	1,117	88.2	743	65.5
No filled prescription(s) of treatment for pain	150	11.8	391	34.5

**Table 4:** Associations between filled prescriptions among nursing home residents grouped by ATC drug category-level and factors: sex, age, pain, Gottfries Cognitive Scale-score, depressive mood, ADL, and QoL. Reported are odds ratios, 95% confidence intervals and *p*-values from multiple logistic regression analysis

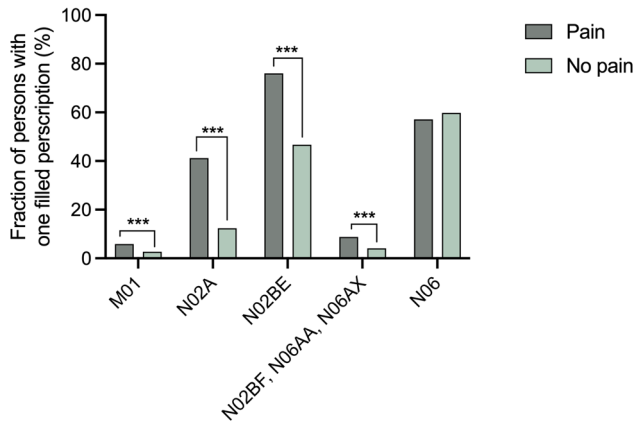
Drug class	Factor	Variable (code)	Reference variable	Odds ratio	95% CI	<i>p</i> value
M01 (NSAIDs including glucosamine)	Sex	Male (1)	1	1.110	0.691, 1.783	0.666
		Female (2)				
	Age	Yes (1)	1	0.984	0.959, 1.010	0.218
		No (2)		2.666	1.617, 4.397	<0.001
	GCS	Yes (1)	0	1.046	1.013, 1.080	0.006
		No (0)		0.899	0.563, 1.437	0.657
	ADL	0-3 (0)	0	1.116	0.704, 1.767	0.641
		4-6 (1)				
	QoL	Male (1)	1	1.003	0.993, 1.014	0.533
		Female (2)		1.227	0.975, 1.545	0.082
N02A (opioids)	Age	Yes (1)	1	1.010	0.997, 1.023	0.131
		No (2)		4.525	3.584, 5.713	<0.001
	Pain	Yes (1)	1	1.012	0.997, 1.026	0.107
		No (0)		0.952	0.758, 1.196	0.673
	GCS	Yes (1)	0	0.811	0.648, 1.017	0.069
		No (0)				
	ADL	0-3 (0)	0	0.994	0.989, 0.999	0.011
		4-6 (1)		1.208	0.980, 1.490	0.076
	QoL	Male (1)	1	1.021	1.009, 1.033	<0.001
		Female (2)		3.745	3.065, 4.575	<0.001
N02BE (paracetamol)	Age	Yes (1)	1	1.020	1.006, 1.033	0.004
		No (2)		0.886	0.719, 1.091	0.255
	Pain	Yes (1)	0	0.660	0.534, 0.816	<0.001
		No (0)				
	GCS	Yes (1)	0	1.000	0.995, 1.004	0.874
		No (0)		1.016	0.654, 1.421	0.936
	ADL	0-3 (0)	0	0.975	0.954, 0.996	0.021
		4-6 (1)		2.268	2.326, 1.537	<0.001
	QoL	Male (1)	1	1.066	1.037, 1.095	<0.001
		Female (2)				
N02BF/N06AA/N06AX (drugs related to neuropathic pain treatment: gabapentin, pregabalin, amitriptyline, and duloxetine)	Age	Yes (1)	1	0.975	0.954, 0.996	0.021
		No (2)		2.268	2.326, 1.537	<0.001
	Pain	Yes (1)	1	1.066	1.037, 1.095	<0.001
		No (2)				
	GCS	Yes (1)	1	1.066	1.037, 1.095	<0.001
		No (2)				

(Continued)

Table 4: *Continued*

Drug class	Factor	Variable (code)	Reference variable	Odds ratio	95% CI	p value
N06 (antidepressants)	Depressive mood	Yes (1)	0	1.478	0.965, 2.264	0.072
		No (0)				
	ADL	0-3 (0)	0	0.525	0.550, 1.187	0.227
		4-6 (1)				
	QoL	Male (1)	1	0.997	0.989, 1.006	0.525
		Female (2)		1.296	1.062, 1.582	0.011
	Age	Yes (1)	1	0.982	0.971, 0.993	0.001
		No (2)		1.141	0.946, 1.377	0.169
	GCS	Yes (1)	0	0.988	0.976, 1.001	0.062
		No (0)		2.205	1.815, 2.679	<0.001
	ADL	0-3 (0)	0	0.936	0.768, 1.142	0.516
		4-6 (1)		0.997	0.993, 1.001	0.153
	QoL					

Abbreviations: GCS; Gottfries cognitive scale, QoL; quality of life, ADL; Katz index of independence in activities of daily living.



**Figure 4:** Association between the presence of pain and prescriptions of drugs relevant for the treatment of pain and depressive symptoms. Y-axis represents the fraction (%) number of prescriptions filled within each group (residents with or without pain). Drug categories are as follows: NSAIDs including glucosamine (M01), opioids (N02A), paracetamol (N02BE), drugs commonly used to treat neuropathic pain (N02BF, N06AA, and N06AX), and antidepressants (N06). Asterisks indicate  $p$ -values from multiple logistic regression analysis; \*\*\* indicates  $p < 0.001$ .

For this SWENIS cohort of 2019, the overall pain prevalence was estimated at 52.8%. These results are in line with previous data from this repeated study that previously reported a 48% pain prevalence [2]. Other published literature includes a regional Swedish study with nursing home residents reporting a pain prevalence of 56.7% [20], and another repeated regional study in 2007 and 2013, reporting a somewhat higher pain prevalence of 63.4 and 62.3%, respectively [21]. Thus, our results can be considered to be in agreement with the other Swedish prevalence studies of pain. Additional pain prevalence reports from neighbouring countries include a pain prevalence of 55% in Norwegian nursing home residents and 57% in Finnish nursing home residents [22,23].

It has been acknowledged that pain assessment is challenging due to the complexity of pain itself. For example, biological, psychological, and social factors influence to a varying degree and there is no consensus on a gold standard pain assessment tool for adults with cognitive impairment [24]. However, there are validated methods available such as PACSLAC-2, Mobilization–Orientation–Behaviour–Intensity–Dementia-2 (MOBID-2), and DOLOPLUS-2 [25].

A large fraction of the population in our study was indeed cognitively impaired, which complicates pain assessment among the population. In these situations, the literature suggests proxy-report over self-report in survey-based research, in our case performed by primary carers [8]. Although proxy reporting of pain symptoms is a limitation of this study as it constricts the exploring of pain descriptions,

ratings, and evaluation of pain types in general, it still enables pain estimations among those who have lost their voice.

The prevalence of being in a depressive mood was estimated at 63.1%, which can be considered high, depending on the data source and definition. A study by Midlöv et al. reported that the prevalence of depression among Swedish nursing home residents was estimated at 9.1% using medical record data, while 46.2% of these residents were being prescribed anti-depressants [26]. It has been reported that the prevalence of major depression and depressive symptoms (including neuropsychiatric symptoms of major NCD) ranges from 4.8 to 81.8% among older adults in long-term care homes in a systematic review, which is indeed a very wide range [27].

Since our results are not based on ICD diagnosis or information from healthcare records, but rather on the proxy estimation of the presence and severity of being in a depressive mood, the information does not provide a clinical diagnosis and can thus include depressive moods and symptoms from a range of other diagnoses, such as neuropsychiatric symptoms originating from major cognitive disorder. This would thus naturally generate a higher prevalence. The lack of fully representative sources for reporting prevalence for most conditions, and the issues with utilizing journal data or proxy-reported data are a discussion that goes beyond the scope of this paper but should be kept in mind when interpreting the results of any paper reporting prevalence since it determines the specificity. However, it should also be noted that utilizing medical record data of diagnoses is perhaps not the best method for reporting the prevalence of pain and depression, particularly among the older populations since a formal diagnosis is sometimes missing.

The presence of pain was found to be associated with the presence of a depressive mood, where 60.5% of enrolled residents assessed to be in a depressive mood to a various extent were also assessed to be in pain. This is an association that seems to be in line with the current literature [28–30]. On the contrary, while investigating the co-occurrence of pain with cognitive impairment we did not find a statistically significant difference between groups. This was somewhat surprising considering that, e.g., chronic pain has been found to be associated with a more rapid memory decline or decline in cognitive performance [28,31]. Moreover, results from a study in the United States have shown that most nursing home residents with major NCD were experiencing pain and 90% were also treated against pain [32].

In terms of pharmacological treatment, the overall prevalence of filled prescriptions of drugs aimed at treating pain was 77.5% of which paracetamol (62.1%) was the most commonly prescribed. Paracetamol is indeed the

preferred option for long-term treatment of pain in the older population due to its safety profile in comparison with other available options. Our report of overall pain treatment can be estimated to be, slightly higher or in agreement with results from other studies of older populations, such as Australian elderly hospital patients reporting 69% use of analgesic medications (of which paracetamol constituted 89%) and the study by Hemmingsson *et al.* reporting 58.2–59.1% paracetamol use of for people living in Swedish nursing homes [20,33].

The presence of opioid prescriptions was estimated to 27.7%, which could be considered to be in line or slightly higher than data for tramadol and opioids combined, from the study by Hemmingsson *et al.* [21]. Another study based on Swedish register data from 2017 declared the prevalence of opioid prescription to be 17.3% among people aged 65 and older enrolled in the Swedish register for cognitive/dementia disorders, SveDem. This is considerably lower than our results, but the difference could be explained by the presumable lower occurrence of cognitive impairment (68.1%) among our residents and current treatment recommendations for this group [13,34].

Drugs related to neuropathic pain, including gabapentin, pregabalin, amitriptyline, and duloxetine, were found to be prescribed and filled by 6.6% of our nursing home residents. The prevalence reported in the literature of these particular drugs as a group was scarce, but in German nursing home residents, prescription of gabapentin and pregabalin alone was estimated at 7.5%, which is higher than our own results for the drug group that also included amitriptyline and duloxetine [35]. A smaller study in Dutch nursing home residents concluded that the use of drugs against neuropathic pain (amitriptyline, gabapentin, carbamazepine) was so low (only 1 resident of 106 reported to be treated) that there could be an indication of sub-treatment [36].

Moreover, we found that 11.8% of residents with proxy reports of pain did not have dedicated pharmacological treatment and that among the residents who reported not being in pain, 65.5% of residents had filled prescriptions within the ATC codes for pain. The latter could simply include a large number of residents with treatment for another indication, or that the pain treatment was effective. Other studies have found similar results regarding nursing home residents with different types of pain that are lacking pharmacological treatment, *e.g.*, Mbrah *et al.* found that 28.2% of nursing home residents with neuropathic pain were lacking pharmacological treatment, and Nunziata *et al.* found that 34% of French nursing home residents with reported pain did not receive pharmacological treatment [37,38].

Prescriptions for antidepressants were filled by 54.1% of the residents. The prevalence of antidepressants was thus higher compared to 46.2% found by Midlöv *et al.* in their study of Swedish nursing home residents and considerably higher than 35.6% found in an observational longitudinal cohort study in Europe and Israel [26,39]. Mirtazapine and citalopram were found as the second and third most commonly prescribed medications in this study (27.5% and 15.6%, respectively). Mirtazapine is recommended for the treatment of neuropsychiatric symptoms (*e.g.* affective symptoms) related to major NCD as well as depression and is reported to have a positive effect on sleep disturbances as well, which might be an explanation for this drug being more commonly prescribed in comparison with other selective serotonin reuptake inhibitors.

In our multiple regression analysis, we found associations between pain and every drug category aimed at treating pain analyzed in this study. This could indicate that treatment is motivated. However, there is no information about pain types or diagnosis in this study that consequently limits us from drawing conclusions of appropriate drug treatment in the individual, which is also true for the following discussion below regarding appropriate prescriptions and associations.

Reports of a depressive mood were found to be associated with residents filling prescriptions of drugs used to treat depressive symptoms (N06A), which could again indicate that treatment is appropriate. In the regression analysis, we did not see an association between drug group of antidepressants and reports of pain, despite the common co-occurrence. We did however find associations between being prescribed antidepressants and variables for female sex and decreasing age.

Considering cognitive impairment in relation to the treatment of pain, the groups of NSAIDs, paracetamol, and drugs for neuropathic pain were all associated with slightly higher GCS scores, *i.e.*, a higher cognitive function. These results either indicate an undertreatment of pain in residents with cognitive impairment, or alternatively, that appropriate considerations have been taken in terms of treatment options for the older population and/or cognitive impaired as suggested by the Swedish National Board of Social Affairs and Health [13]. The latter also highlights the challenges of pharmacological treatment for pain, especially in the older populations, where not only a lack of effectiveness, but also frequent unwanted side effects are major recognized issues with currently available pharmacological treatments. However, as mentioned in the introduction of this article, there is evidence of undertreatment of pain in people with major cognitive disorder or cognitive impairment, which warrants for additional attention in this group.

QoL was estimated at 62.8 ( $\pm 23.3$ ), which was similar to Dutch nursing home residents ( $63.1 \pm 14.7$ – $64.7 \pm 17.3$ ) [40], compared to 79.5 ( $\pm 18.3$ ) for the general Swedish population [41]. Lower QoL was found to be associated with opioids in our study, which could be explained by other factors such as the reason for treatment since treatment with opioids has been found to improve baseline QoL in chronic pain patients [42]. Finally, we found an association between female sex and prescription of antidepressants, which has also been recognized elsewhere [43].

## 4.1 Strengths and limitations

This present study adds to the literature concerning prevalence data for pain, cognitive impairment, depressive mood, as well as prevalence of pharmacological treatment for pain and antidepressants among nursing home residents in Sweden. The SWENIS survey is part of a larger research project and has been previously submitted every 4 years with a planned follow-up in 2024. Except for the limitations discussed above, there are limitations to all cross-sectional studies in terms of causality. Data were collected by proxy assessors who received no training but were instructed to be done by the member of staff who knew the resident best. This study was not supplemented with data on diagnosis from the Swedish National Patient Register due to the complexity of diagnosing the conditions included in this study. The question used to assess pain prevalence in the SWENIS surveys does not distinguish between acute, prolonged, or momentary pain and can thus include various types of pain states. This could under- or overestimate the number of residents reported to experience pain. However, this survey and the Swedish National Drug Register comprise a large sample on a national level which argues for its generalizability.

## 4.2 Conclusions

Our results indicate that pain is common among nursing home residents in Sweden and that pain and depressive mood are frequently co-occurring. Drugs commonly used for pain management were prescribed to a majority of residents, but there was still a considerable fraction of residents with reports of pain that did not fill any prescriptions of pain medications. It is thus important to further explore the relationship between pain, depressive mood, and cognitive impairment in regard to pain management in nursing home residents.

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**Informed consent:** Not applicable.

**Author contributions:** The authors have accepted responsibility for the entire content of this manuscript and approved its submission. Conceptualization and design were performed by all authors (ML, HL, DE, AB, MG, AS, LR) including the design of analysis by ML. The formal analysis was performed by LR. Data collection was performed by DE, HL, AS, AB, and ML. The first draft of the manuscript was prepared by LR and supervised by MG. All authors contributed to reviewing and editing the manuscript.

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