Chronic pain and use of analgesics in the elderly: a nationwide population-based study

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Abstract

Introduction: Chronic pain may cause many comorbidities in the elderly; however, nationwide data about this issue remain insufficient. We conducted this study to address the data gap.

Material and methods: We identified geriatric participants (≥ 65 years) with chronic pain between 2000 and 2013 from the Taiwan National Health Insurance Research Database. The causes of chronic pain and use of analgesics between two sexes and among three age subgroups were compared.

Results: A total of 21,018 participants were identified with the mean age (standard deviation) of 72.7 years (5.6) and the female percentage of 50.8%. The prevalence of chronic pain in the elderly was 21.5%, and it was higher in the females than males. The proportions of each age subgroup were 65–74 (66.8%), 75–84 (29.4%), and ≥ 85 years (3.8%). Common causes of chronic pain were osteoarthritis (21.9%), spinal disorders (19.0%), peripheral vascular diseases (12.4%), and osteoporosis (11.4%). Non-steroidal anti-inflammatory drugs were the most common medication, followed by acetaminophen and opioids. The most commonly used opioid was morphine. The use of opioids increased with age.

Conclusions: This study delineated the causes of chronic pain and use of analgesics in a geriatric population, which may help further studies about this issue in the future.

Key words: acetaminophen, chronic pain, elderly, geriatric, non-steroidal anti-inflammatory drugs.

Introduction

Aging is an important issue in public health worldwide. In the United States, the population aged 65 and over is projected to reach 83.7 mil-

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lion in 2050, which is almost double the number in 2012 [1]. Taiwan is one of the most rapidly aging countries in the world [2, 3]. In 2013, the geriatric population was 13.3% in Taiwan; however, it will rapidly grow to 20% by 2025 [2, 3]. The growing geriatric population will contribute to a serious burden on the health care system because the elderly use more medical resources than their younger counterparts due to their multiple and complex comorbidities [3–11]. The statistics from the Taiwan National Health Insurance demonstrated that the geriatric population contributed to 38.5% of the total expenditures in 2015, and the proportion is still growing [12].

Chronic pain in the elderly is defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage, for persons who are age ≥ 65 years with pain for greater than 3 months" [13]. Chronic pain may cause impaired activities of daily living, depression, deconditioning, polypharmacy, and cognitive decline in the elderly, which may further contribute to the poor quality of life in the affected elderly and increased burdens of caregiver and medical health system [13, 14]. Understanding the causes of chronic pain, treatments in the geriatric population, and subsequent interventions, is crucial. However, nationwide data about this issue are insufficient, so this study was conducted to fill the data gap.

Material and methods

Data sources

For this study we used the Longitudinal Health Insurance Database 2000 (LHID2000), which contains 1,000,000 beneficiaries registered in the year 2000 randomly selected from the original National Health Insurance Research Database (NHIRD) [15]. No significant difference is found in the sex distribution between the LHID 2000 and NHIRD. The Taiwan NHIRD, which covers nearly 100% of the population's healthcare data, is one of the most comprehensive databases in the world [16].

Study design, setting, and participants

We conducted this nationwide population-based study by identifying all the geriatric participants (≥ 65 years) with chronic pain between January 1, 2000 and December 31, 2013 from the LHID 2000 (Figure 1). Demographic variables including age, sex, and living areas, causes of chronic pain, other comorbidities, and use of analgesics were included in the analysis. We compared causes of chronic pain and use of analgesics between two sexes and among three age subgroups (65–74, 75–84, and ≥ 85 years).

Definitions of variables

Given the lack of direct data about chronic pain in the NHIRD, we defined subjects with chronic pain as the participants who have used either acetaminophen, non-steroidal anti-inflammatory drugs (NSAIDs; excluding aspirin), or opioids for at least 3 months. The standardized tools for pain assessment commonly used in Taiwan were the visual analog scale, numeric rating scale, and face rating scale. The causes of chronic pain were defined as follows: osteoarthritis (International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM): 715), spinal disorders (ICD-9-CM: 756.11, 756.12, 720-725, 737.1-737.4), peripheral vascular diseases (ICD-9-CM:
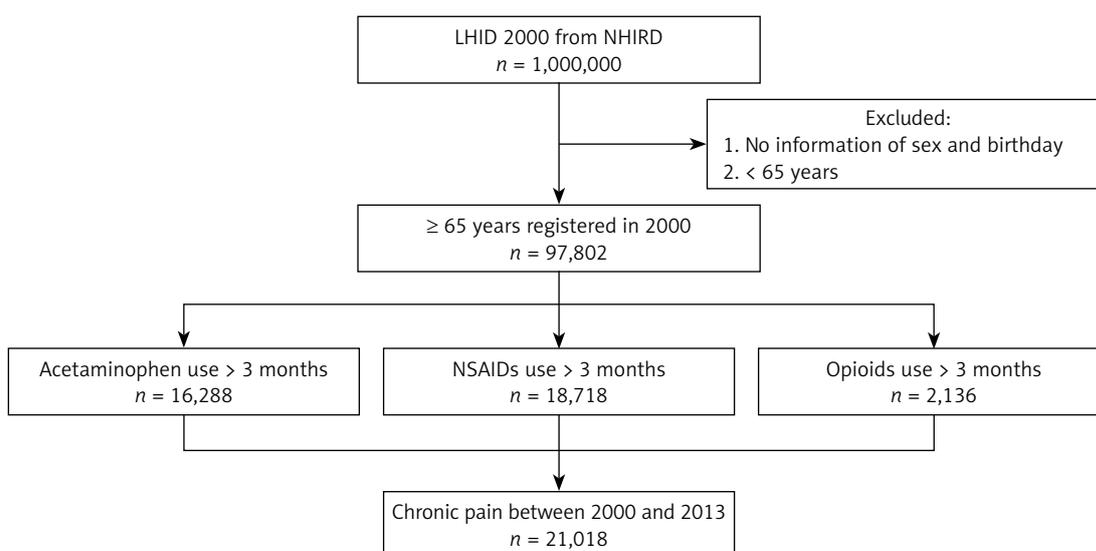

Figure 1. Flowchart of this study. NHIRD, National Health Insurance Research Database

NSAID – non-steroidal anti-inflammatory drug.

443.8-444.9), osteoporosis (ICD-9-CM: 733.0), malignancy (ICD-9-CM: 140-208), gout (ICD-9-CM: 274), headache (ICD-9-CM: 307.81, 784.0, 346), diabetic neuropathy (ICD-9-CM: 250.6, 357.2), rheumatoid arthritis (ICD-9-CM: 714), pressure ulcer (ICD-9-CM: 707), and herpes zoster (ICD-9-CM: 053). The other comorbidities were defined as follows: hypertension (ICD-9-CM: 401–405), diabetes (ICD-9-CM: 250), stroke (ICD-9-CM: 430-438), coronary artery disease (ICD-9-CM: 410-414), chronic obstructive pulmonary disease (ICD-9-CM: 490-496), renal diseases (ICD-9-CM: 580-593), hyperlipidemia (ICD-9-CM: 272), liver diseases (ICD-9-CM: 570-576), dementia (ICD-9-CM: 290, 291.2, 292.82, 294.1), and depression (ICD-9-CM: 300.4). The participants who had the diagnosis of causes of chronic pain and comorbidities in at least one hospitalization or three out-patient clinics were defined as having the disease.

Ethical statements

This study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board at Chi-Mei Medical Center. Considering that the data in the LHID2000 are unidentifiable and secondary data released to the public for research, informed consent was waived. The waiver does not affect the rights and welfare of the participants.

Statistical analysis

We used SAS 9.4 for Windows (SAS Institute, Cary, NC, USA) for all statistical analyses. Pearson chi-square tests were used for categorical variables (i.e., age subgroup, sex, causes of chronic pain, other comorbidities, living areas, and pain killers in Tables I–IV), and the independent t test was used for continuous variables (i.e., age in Table I). The significance level was set at $p < 0.05$ (two-tailed).

Results

Comparison of causes of chronic pain between the two sexes

A total of 21,018 participants were identified in this study (Figure 1, Table I). The mean age ± standard deviation was 72.7 ±5.6 years, and the female percentage was 50.8%. The prevalence of chronic pain in the elderly was 21.5%, and it was higher in the females than in the male population (23.6% vs. 19.7%; Figure 2). The age of 65–74 years was the largest subgroup (66.8%), followed by 75–84 years (29.4%). The common causes of chronic pain were osteoarthritis (21.9%), spinal disorders (19.0%), peripheral vascular diseases (12.4%), osteoporosis (11.4%), malignancy

(7.2%), gout (4.4%), headache (3.8%), diabetic neuropathy (1.7%), rheumatoid arthritis (1.6%), pressure ulcer (1.3%), and herpes zoster (0.6%). In the comparison of causes of chronic pain between the two sexes, the female participants had a higher percentage of osteoarthritis (23.2% vs. 20.5%), spinal disorders (19.9% vs. 18.2%), osteoporosis (17.3% vs. 5.3%), diabetic neuropathy (2.1% vs. 1.4%), and rheumatoid arthritis (2.0% vs. 1.2%) than the male participants. The female participants with chronic pain had higher prevalence of hypertension (53.8% vs. 50.0%), diabetes (25.4% vs. 19.9%), and hyperlipidemia (9.8% vs. 7.4%) than their male counterparts. Depression was diagnosed in only 0.2% of the total participants. Nearly half of the participants lived in North Taiwan (47.0%), followed by those who lived in South Taiwan (30.5%).

Comparison of causes of chronic pain between age subgroups

A comparison of the causes of chronic pain among age subgroups showed that peripheral vascular diseases, osteoporosis, and pressure ulcer increased with advancing age (Table II). The prevalence of comorbidities with stroke, coronary artery disease, chronic obstructive pulmonary disease, renal diseases, and dementia was higher in the older subgroup than in the younger subgroup.

Comparison of pain killers between the two sexes and age subgroups

NSAIDs were the most commonly used analgesics (89.1%), followed by acetaminophen (77.5%) and opioids (10.2%; Table III). Pethidine was the most commonly used opioid (6.6%). The percentage of male participants who used opioids was higher than that of female participants (11.9% vs. 8.5%). With advancing age, more participants used opioids as analgesics (65–74 years: 9.8% vs. 75–84 years: 10.6% vs. ≥ 85 years: 13.4%).

Discussion

This study showed that musculoskeletal and rheumatic disease disorders were the most common causes of chronic pain in the elderly; this finding was consistent with the results of previous studies [13, 17, 18]. Osteoarthritis, a common joint disorder in the world, is one of the most common causes of pain and disability in the geriatric population [18–21]. The greatest risk factor for osteoarthritis is old age, and other risk factors are joint injury, obesity, genetics, anatomical factors, and female sex [19, 22]. The most common joint affected is the knee, followed by the hip and hands [19]. Spinal disorders encompass a broad spectrum of pathologies including congenital, de-

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Table I. Comparison of causes of chronic pain in the elderly between two sexes

Variables	Total n = 21018	Female n = 10677	Male n = 10341	*P*-value*
Age (mean ± SD)	72.7 ±5.6	72.6 ±5.9	72.8 ± 5.4	0.009
Age subgroup, *n* (%):				
65–74 years	14048 (66.8)	7139 (66.9)	6909 (66.8)	0.046
75–84 years	6172 (29.4)	3100 (29.0)	3072 (29.7)	
≥ 85 years	798 (3.8)	438 (4.1)	360 (3.5)	
Causes of chronic pain[†]:				
Osteoarthritis	4598 (21.9)	2477 (23.2)	2121 (20.5)	< 0.001
Spinal disorders	4002 (19.0)	2120 (19.9)	1882 (18.2)	0.002
Peripheral vascular diseases	2596 (12.4)	1166 (10.9)	1430 (13.8)	< 0.001
Osteoporosis	2394 (11.4)	1851 (17.3)	543 (5.3)	< 0.001
Malignancy	1504 (7.2)	594 (5.6)	910 (8.8)	< 0.001
Gout	914 (4.4)	227 (2.1)	687 (6.6)	< 0.001
Headache	792 (3.8)	429 (4.0)	363 (3.5)	0.053
Diabetic neuropathy	365 (1.7)	221 (2.1)	144 (1.4)	< 0.001
Rheumatoid arthritis	337 (1.6)	214 (2.0)	123 (1.2)	< 0.001
Pressure ulcer	281 (1.3)	120 (1.1)	161 (1. 6)	0.006
Herpes zoster	125 (0.6)	48 (0.5)	77 (0.7)	0.005
Other comorbidities[‡]:				
Hypertension	10917 (51.9)	5744 (53.8)	5173 (50.0)	< 0.001
Diabetes	4769 (22.7)	2708 (25.4)	2061 (19.9)	< 0.001
Stroke	3881 (18.5)	1745 (16.3)	2136 (20.7)	< 0.001
Coronary artery disease	3542 (16.9)	1689 (15.8)	1853 (17.9)	< 0.001
Chronic obstructive pulmonary disease	2540 (12.1)	772 (7.2)	1768 (17.1)	< 0.001
Renal diseases	2323 (11.1)	1040 (9.7)	1283 (12.4)	< 0.001
Hyperlipidemia	1813 (8.6)	1045 (9.8)	768 (7.4)	< 0.001
Liver diseases	1763 (8.4)	860 (8.1)	903 (8.7)	0.077
Dementia	886 (4.2)	438 (4.1)	448 (4.3)	0.407
Depression	36 (0.2)	16 (0.2)	20 (0.2)	0.445
Living areas:				
North	9868 (47.0)	4836 (45.3)	5032 (48.7)	< 0.001
Center	3963 (18.9)	2055 (19.3)	1908 (18.5)	
South	6411 (30.5)	3406 (31.9)	3005 (29.1)	
East	776 (3.7)	380 (3.6)	396 (3.8)	

*Data are presented as number (percentage) or mean ± SD. SD – standard deviation. *Comparison between female and male participants. †Participant may have multiple causes of chronic pain. ‡Participant may have multiple comorbidities.*

velopmental, degenerative, traumatic, infectious, inflammatory, and neoplastic disorders [23]. Aging will lead to an increasing burden of spinal disor-

ders on the health care system [23]. In the report in the United States, when the elderly comprised 17% of the population, they were responsible for

Table II. Comparison of causes of chronic pain in the elderly among three age subgroups

Variables	Total n = 21018	65–74 n = 14048	75–84 n = 6172	≥ 85 n = 798	P-value*
Female	10677 (50.8)	7139 (50.8)	3100 (50.2)	438 (54.9)	0.046
Male	10341 (49.2)	6909 (49.2)	3072 (49.8)	360 (45.1)	
Causes of chronic pain[†]:					
Osteoarthritis	4598 (21.9)	3247 (23.1)	1217 (19.7)	134 (16.8)	< 0.001
Spinal disorders	4002 (19.0)	2803 (20.0)	1107 (17.9)	92 (11.5)	< 0.001
Peripheral vascular diseases	2596 (12.4)	1585 (11.3)	894 (14.5)	117 (14.7)	< 0.001
Osteoporosis	2394 (11.4)	1480 (10.5)	798 (12.9)	116 (14.5)	< 0.001
Malignancy	1504 (7.2)	1023 (7.3)	439 (7.1)	42 (5.3)	0.098
Gout	914 (4.4)	627 (4.5)	261 (4.2)	26 (3.3)	0.230
Headache	792 (3.8)	596 (4.2)	171 (2.8)	25 (3.1)	< 0.001
Diabetic neuropathy	365 (1.7)	271 (1.9)	84 (1.4)	10 (1.3)	0.010
Rheumatoid arthritis	337 (1.6)	246 (1.8)	88 (1.4)	3 (0.4)	0.005
Pressure ulcer	281 (1.3)	149 (1.1)	111 (1.8)	21 (2.6)	< 0.001
Herpes zoster	125 (0.6)	79 (0.6)	43 (0.7)	3 (0.4)	0.372
Other comorbidities[‡]:					
Hypertension	10917 (51.9)	7291 (51.9)	3237 (52.5)	389 (48.8)	0.142
Diabetes	4769 (22.7)	3419 (24.3)	1224 (19.8)	126 (15.8)	< 0.001
Stroke	3881 (18.5)	2345 (16.7)	1338 (21.7)	198 (24.8)	< 0.001
Coronary artery disease	3542 (16.9)	2238 (15.9)	1155 (18.7)	149 (18.7)	< 0.001
Chronic obstructive pulmonary disease	2540 (12.1)	1399 (10.0)	987 (16.0)	154 (19.3)	< 0.001
Renal diseases	2323 (11.1)	1494 (10.6)	721 (11.7)	108 (13.5)	0.007
Hyperlipidemia	1813 (8.6)	1393 (9.9)	404 (6.6)	16 (2.0)	< 0.001
Liver diseases	1763 (8.4)	1275 (9.1)	444 (7.2)	44 (5.5)	< 0.001
Dementia	886 (4.2)	434 (3.1)	366 (5.9)	86 (10.8)	< 0.001
Depression	36 (0.2)	26 (0.2)	9 (0.2)	1 (0.1)	0.783
Living areas:					
North	9868 (47.0)	6436 (45.8)	3020 (48.9)	412 (51.6)	< 0.001
Center	3963 (18.9)	2696 (19.2)	1137 (18.4)	130 (16.3)	
South	6411 (30.5)	4398 (31.3)	1788 (29.0)	225 (28.2)	
East	776 (3.7)	518 (3.7)	227 (3.7)	31 (3.9)	

Data are presented as number (percentage). *Comparison among three age subgroups. [†]Participant may have multiple causes of chronic pain. [‡]Participant may have multiple comorbidities.

Table III. Comparison of pain killers in the elderly with chronic pain between two sexes*

Variables	Total n = 21018	Female n = 10677	Male n = 10341	P-value[†]
Acetaminophen	16288 (77.5)	8236 (77.1)	8052 (77.9)	0.207
NSAIDs	18718 (89.1)	9554 (89.5)	9164 (88.6)	0.045
Opioids:	2136 (10.2)	909 (8.5)	1227 (11.9)	< 0.001
Morphine	1072 (5.1)	440 (4.1)	632 (6.1)	< 0.001
Fentanyl	454 (2.2)	182 (1.7)	272 (2.6)	< 0.001
Pethidine	1383 (6.6)	593 (5.6)	790 (7.6)	< 0.001

Data are presented as number (percentage). *Participant may use multiple types of pain killers. NSAIDs – non-steroid anti-inflammatory drugs. [†]Comparison between female and male participants.

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Table IV. Comparison of pain killers in the elderly with chronic pain among age subgroups

Variables	Total	65–74	75–84	≥ 85	*P*-value[†]
Acetaminophen	16288 (77.5)	10949 (77.9)	4725 (76.6)	614 (76.9)	0.088
NSAIDs	18718 (89.1)	12590 (89.6)	5450 (88.3)	678 (85.0)	< 0.001
Opioids:	2136 (10.2)	1376 (9.8)	653 (10.6)	107 (13.4)	0.002
Morphine	1072 (5.1)	705 (5.0)	312 (5.1)	55 (6.9)	0.064
Fentanyl	454 (2.2)	327 (2.3)	115 (1.9)	12 (1.5)	0.048
Pethidine	1383 (6.6)	873 (6.2)	441 (7.2)	69 (8.7)	0.003

*Data are presented as number (percentage). *Participant may use multiple types of pain killers. †Comparison among three age subgroups. NSAIDs – non-steroid anti-inflammatory drugs.*
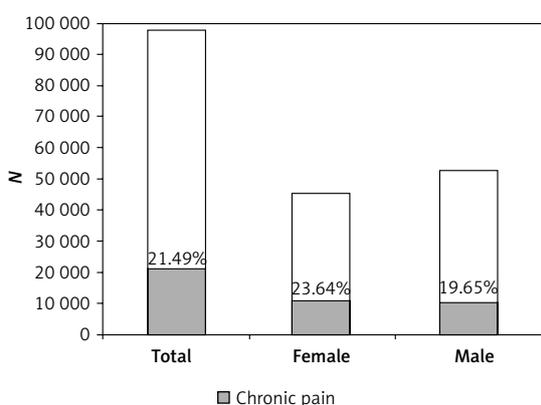

Figure 2. Prevalence of chronic pain in the geriatric participants

nearly half of all hospitalization for low back conditions [19]. Osteoporosis is a common disorder associated with a large burden of morbidity and mortality in the elderly [24]. In addition to pain and disability, osteoporosis may cause morbidity, fragility fractures, and increased risk of mortality [24]. Peripheral vascular diseases are chronic arterial occlusive diseases of the lower extremities [25]. Peripheral vascular diseases may cause intermittent claudication with pain or weakness during walking, which may be relieved with rest [25]. Victims with peripheral vascular diseases have increased risk for coronary artery disease, stroke, and subsequent all-cause mortality, cardiovascular mortality, and cardiovascular events [25]. Aging is a high risk factor for malignancy, with the geriatric population accounting for 60% of newly diagnosed malignancies and 70% of all cancer deaths in the United States [26, 27]. The common malignancies in the elderly are lung, colon, stomach, liver, prostate, and breast cancers [28].

In this study, the female participants demonstrated a higher prevalence of osteoarthritis, spinal disorders, osteoporosis, diabetic neuropathy, and rheumatoid arthritis as the causes of chronic pain than the male participants. Many studies revealed a difference in response to pain between the two sexes [29]. Women have more pain sensitivity and risk for pain than men [29]. In addition, differences in pharmacological and non-pharmacological pain interventions in the two sexes were observed [29]. However, these differences depend on the etiology, treatment, and characteristics of the provider [29]. Osteoarthritis is more common in women than in men [30]. Joint anatomy, kinematics, previous joint injury, and hormonal influences may play important roles [30]. Women always receive treatment for osteoarthritis in more advanced stages and have more debilitating pain than their male counterparts [30]. The prevalence of spinal disorders also suggests a sex difference. A study in 2015 showed that spondylosis and low back pain are more prevalent in women than in men (7.8% vs. 3.3% and 76.2% vs. 73.9%, respectively) [31]. This study revealed that female participants have a higher prevalence of diabetic neuropathy as chronic pain than male participants. A study recruiting 1705 patients with type 2 diabetes in 2010 reported that the prevalence of diabetic neuropathy was 78.8% without a sex difference [32]. Men may develop diabetic neuropathy earlier than women [32, 33]. However, the pain sensation is not equal to the development of diabetic neuropathy. In addition, the data were gathered from general adults and not from a geriatric population [32, 33]; therefore, further studies are required to confirm the results of this study. Rheumatoid arthritis is more common in women than in men [34]. The incidence of rheumatoid arthritis in women is four to five times higher than that in men below the age of 50 years, but the women/men ratio is about 2 above 60–70 years [34].

The prevalence of most diseases is high in the elderly. However, only peripheral vascular diseases, osteoporosis, and pressure ulcer as the causes of chronic pain increased with age in this study. The possible explanation is that we identified the participants with chronic pain in this study. The participants who had the diseases but no diagnosis of "chronic pain" were not analyzed. Pain is a subjective sensation, and it may not be expressed completely in the elderly with advancing

age [35]. Therefore, chronic pain in this population may be underestimated [35].

The most common analgesics used in this study were NSAIDs. The suggested analgesics from mild to severe pain are acetaminophen, NSAIDs, and opioids [17, 36, 37]. The use of opioids in this study was more common in the age ≥ 85 years than in the other age subgroups, thereby suggesting that pain severity increased with advancing age. A combination of drugs is encouraged because it can enhance the effectiveness of analgesics and avoid the toxicity resulting from the use of a single agent at high doses [17, 36–39].

This study has the major strength of a nationwide population-based design, which helps provide a general overview of chronic pain in the elderly. However, the study had the following limitations. First, the definition of chronic pain was the use of analgesics for more than 3 months, which may underestimate the prevalence of chronic pain. Second, the participants might have multiple causes of chronic pain in this study, but we could not identify the major cause. Third, we did not investigate whether chronic pain was an independent predictor of mortality or specific diseases. We conducted this study to reveal a general picture of chronic pain in the elderly. Subsequent studies about whether chronic pain is an independent predictor of mortality or specific diseases and a prediction model for chronic pain will be conducted. Fourth, although this was a nationwide population-based study, it may not be generalized to other nations due to differences in race, culture, and medical resources. Further studies about the correlation between database and hospital data and other nations are warranted to validate the results of this study.

In conclusion, this nationwide population-based study demonstrated that the prevalence of chronic pain was 21.5%, and it was higher in the females than in the male population. The major causes of chronic pain were osteoarthritis, spinal disorders, peripheral vascular diseases, osteoporosis, and malignancy. The female participants had higher incidence of osteoarthritis, spinal disorders, osteoporosis, diabetic neuropathy, and rheumatoid arthritis as the cause of chronic pain than the male participants. NSAIDs were the most commonly used analgesics, and the use of opioids increased with advancing age. This study provided a general picture of chronic pain in the elderly, which may help subsequent studies on this issue in the future.

Acknowledgments

Conflict of interest

The authors declare no conflict of interest.

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