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ORIGINAL RESEARCH

Burden of disease of chronic pain in Ecuador

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ABSTRACT

Objectives: To estimate the burden of disease related to chronic pain in Ecuador.

Methods: We used Global Burden of Disease (GBD) methods to estimated disability-adjusted life years (DALYs) related to chronic pain in Ecuador related to lumbar pain, osteoarthritis, post-herpetic neuralgia, diabetic neuropathy, cancer-related pain, and other musculoskeletal pain. We estimated the prevalent cases by sex and age group using literature data. We only estimated years lived with disability using disability weights obtained from the GBD, with the assumption that no premature death would be related to pain. We used a prevalence-based approach to estimate cases by sex and age group using literature, without discounting or age adjustment. We calculated total DALYs and DALYs/100,000 inhabitants.

Results: Our estimated yielded a total of 3,644,108 patients with chronic pain. They would produce 256,090 DALYs or 1,483 DALYs/100,000 inhabitants attributable to chronic pain. Low back pain, osteoarthritis and cancer-related pain were the drivers of DALY production.

Conclusions: Chronic pain is an important source of burden of disease. It is comparable to other important causes such as headaches, stroke, diabetes and chronic obstructive pulmonary disease, among others. Low back pain, osteoarthritis and other musculoskeletal pain were the biggest contributors given their high prevalence.

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KEYWORDS
Burden of disease; chronic pain; disability-adjusted life years; pain; Ecuador

1. Introduction

Pain constitutes one of the most common reasons for medical consultation among individuals of different age ranges and is characterized as a sensory and emotional experience that manifests itself in an individualized way [1,2]. According to the International Association for the Study and Treatment of Pain (IASP), pain is defined as an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage [3]; it is classified as chronic pain when the pain lasts more than 3 months or is later than the estimated healing time of an injury, being persistent even when there is no identifiable cause that can explain its presence. Chronic pain can originate from continuous stimulation or changes at the nociceptor level due to localized tissue damage, as a result of acute injury or disease, or damage to the central or peripheral nervous system, or both [4]. In addition, it includes symptomatic, subjective, pathophysiological and biopsychosocial factors that interact to mediate the pain response, so its diagnosis is often challenging and its treatment requires a multifactorial approach [2,4,5].

Chronic pain is a widespread health problem that exerts a social and economic burden [4]. In 2016, the Global Burden of Disease (GBD) Study reaffirmed the relevance of pain and pain-associated diseases as the main reason for disability and burden of disease worldwide, which has presented an increase as a function of years lived with disability, mainly associated with recurrent headaches, low back, and neck pain [6]. The overall prevalence of chronic pain has been estimated at 30.3% ± 11.7% considering all causes worldwide [7]. For developing countries, a prevalence of 18% has been reported (95% confidence interval: 10–29%) [8]. The prevalence of this condition has not been measured in Ecuador and the information closest to context is that reported for Colombia [9]. According to a survey by the Colombian Association for the Study of Pain, almost half of the population surveyed reported having experienced some type of pain during the last month. About 50% of the patients who felt pain presented a chronic type of pain. Fifty-two percent accepted that their daily activities (work, academic, home, others) were interrupted because of a health problem [9,10].

The economic impact of chronic pain is high since it is related to an increase in the use of health resources and productivity losses [11,12]. This increase in resource consumption is related to the complex nature of chronic pain, which in most cases requires interdisciplinary approaches and complex treatments that include multiple medications, interventional techniques such as nerve blocks, surgery, implantable drug delivery systems and spinal cord stimulators, physical rehabilitation and psychological treatments [4]. For the United States, the Interagency Task Force on Pain Management Best

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Practices estimated that 50 million to 100 million people have chronic pain, making it the most prevalent, costly, and disabling health condition in the United States. Pain (acute and chronic) caused estimated costs in the United States between $560 billion and $635 billion annually [13]. This estimate includes the costs associated with health care and lost productivity costs. Few studies have evaluated this topic in Latin American. A group in Chile estimated that $1.39 billion dollars (approximately US$1.30 billion dollars at constant 2010 prices) of total annual costs could be associated with chronic musculoskeletal pain . This is equivalent to 0.417% of the gross domestic product. It is important to consider that estimations for each country are difficult to compare considering differences in methods, local cost and types of pain being considered. In Chile, they estimated 137,037 disability-adjusted life years (DALYs) related to chronic pain [14].

Burden of disease can summarize the impact on quality and quantity of life using DALY [15,16]. They include both the losses related to premature death (years of life lost) and those related to disability (years of life lived with disability) [17]. Some disease-burden studies have been published, but most have been limited to musculoskeletal pain [17]. Considering the lack of information related to the impact of chronic pain [18], the objective of this study was to assess the burden of disease of chronic pain in Ecuador.

2. Materials and methods

We used the methodology proposed by the WHO and the GBD to estimate the burden of disease of chronic pain [19]. The data was analyzed using Excel 365 (Microsoft®, Redmond, WA, USA). No ethics committee approval was required for this study.

2.1. Pathologies related to chronic pain

We identified ICD-10 codes that were related with pathology that could produce chronic pain, considering the causes identified by WHO [20]. We grouped those causes in six categories: post-herpetic neuralgia, diabetic neuropathy, chronic low back pain, osteoarthritis, musculoskeletal conditions (include diagnosis as unspecified rheumatoid arthritis), and oncological pain. (Supplementary table 1).

2.2. Data sources

For this study, we used the most recent available projected population reported for 2019 by the National Institute of Statistics and Census (INEC) [21], considering the age and sex distribution. The demographic information obtained from INEC was used as a denominator in the calculation of the prevalence of each health condition and the DALY rate per 100,000 inhabitants (Supplementary table 2).

For post-herpetic neuralgia, prevalence information was obtained from the study by Yang et al [22]. The prevalence of post-herpetic neuralgia was assumed to be 0% below the age of 40 years. For diabetic neuropathy, we considered the study by Abbott et al [23] who estimated the prevalence in a group of patients diagnosed with diabetes. Information on the total number of cases with diabetes was obtained from the GBD portal of the IHME [24]. The age distribution was assumed to be proportional to the age distribution of the general population of Ecuador for the year 2019. The prevalence of diabetic neuropathy was assumed to be 0% below the age of 15 years. We then estimated the quantity of patient that had chronic pain for both post-herpetic neuralgia and diabetic neuropathy. We identified a study describing the proportion of patients affected by localized neuropathic pain (LNP) for each condition [25]. 83.3% of cases with post-herpetic neuralgia and 62.9% with diabetic neuropathy were considered to have LNP. For other types of pain, such as low back pain or oncological pain, the analysis could not be performed because there is insufficient information to define the percentage of cases with chronic pain.

The cases for chronic low back pain, osteoarthritis, other musculoskeletal conditions and cancer were obtained from the GBD projections [24] because the local data were considered to be underestimated. Details of the cases of chronic pain associated with each cause can be found in the Supplementary Material (Tables 3 to 8).

To calculate the number of patients who could have chronic cancer pain, we considered data from a prospective multicenter observational study conducted in France with 1885 patients [26]. The authors described that 28.2% of patients had some form chronic pain (95% confidence interval (95% CI) 26.3–30.5). In our calculations, we assumed that this proportion would be homogenous in all age groups

2.3. Calculation of DALYs

DALYs include years of life lost due to premature death (YLL) and years of life lost due to disability (YLD) [19]. This estimation is performed for each pathology (a), age group (i) and sex (j). Total DALY result from the addition of all individual groups.

$$DALY_{aij} = YLL_{aij} + YLD_{aij}$$

We calculated results as overall DALYs and DALYs per 100,000 inhabitants.

We assumed that no premature death would be produced by chronic pain directly. As such we did not calculate YLLs.

For the YLD, we considered a prevalence-based approach considering the currently accepted methods by the GBD studies, with no discounting or age adjustment [15,19,27]. We identified the total number of cases (C) for each pathology and multiplied it by the disability weights (DW) attributable to the pathology. In this approach, the time duration of the sequela is not considered.

$$YLD_{aij} = C_{aij} \times WD_a$$

For each pathology, the list of sequelae was searched for those corresponding to the group of pathologies of interest [15]. The list in the 2017 GBD study was used for this study [15].

- For diabetic neuropathy, we identified a specific health condition, with a disability weight of 0.133 (95% CI 0.089 to 0.187).

- For post-herpetic neuropathy, we identified a health condition for active herpes zoster (0.058, 95% CI 0.035 to 0.090). However, we considered that it was not adequate since we only wanted to highlight neuropathic pain. We assumed that the same disability weight of diabetic neuropathy could be applicable (0.133 with 95% CI 0.089 to 0.187).
- For chronic low back pain, we identified eight sequelae [28]. We obtained the frequency of each level of disability weight from an estimate for Colombia [29]. With this information, we calculated the combined disutility weight. (Supplementary table 9)
- For osteoarthritis, we identified three health conditions [28]. We identified a distribution of the levels of disability weights from low- and middle-income countries [30] and used it to estimate a combined disutility weight. (Supplementary table 9)
- For cancer-related pain, we did not identify a specific health conditions. There are two health conditions related to: cancer diagnosis and primary treatment (0.288, 95% CI 0.193 to 0.399) and management of the terminal phase (0.540, 95% CI 0.377 to 0.687) [28]. They both include pain and many other symptoms related to cancer In order to account for this uncertainty and that the disability weight can include other symptoms, we assumed the least severe disability weight (cancer diagnosis and primary treatment) was considered for all patients.
- For the categories of other types of pain, we did not identify a general health condition but found several that were applicable to specific diseases, with a great range of disability weights. We assumed a conservatively low level of disutility considering the heterogeneity of the category, (0.023, 95% CI 0.013 to 0.037) [28].

3. Results

3.1. Epidemiological estimation

A total of 3,644,108 patients with chronic pain were identified, corresponding to 21% of the total population. The distribution of pathologies by age and group is described in Table 1 and specific base values for each group are presented in Supplementary tables 3–8. The most frequent pathology were other musculoskeletal conditions (1,309,402 cases) followed by osteoarthritis (1,062,016 cases). (Supplementary material, Figure S1) The least frequent were oncological pain, post-herpetic neuralgia, and diabetic neuropathy. The age group with the most total patients identified was between 55 and 59 years old (391,652 cases) which represents 10.7% of the total number of cases.

All pathologies showed a clear increase in their rate per 100,000 inhabitants with age (Figure 1). This trend is particularly pronounced for osteoarthritis.

3.2. Estimation of DALYs

From this, a total of 256,090 DALYs produced were estimated, with a rate of 1,483 DALYs per 100,000 inhabitants. The specific groups of pathologies with the highest production of DALYs were chronic low back pain (105,818 DALYs; 613 DALYs/100,000), osteoarthritis (71,474 DALYs; 413 DALYs/100,000) and other musculoskeletal conditions (30,116 DALYs; 174 DALYs/100,000). Table 2 shows the detailed information. LNP was associated with 27,521 DALYs (159 DALYs/100.00) representing 70.5% of the burden with respect to post-herpetic neuralgia and diabetic neuropathy. With respect to the total burden of chronic pain, LNP would account for 10.7%.

For the DALY rate per 100,000 inhabitants, there is also a trend of increasing with age, like the data for the number of cases, with less emphasis on chronic low back pain. (Supplementary material, Figure S2) Nevertheless, this group was the one with the highest rate in all age groups. (Figure 2)

4. Discussion

Chronic pain has been an underestimated condition due to the lack of a specific diagnosis to report it in a systematic way. We estimated the burden of disease for chronic pain in Ecuador using DALYs as a summary measure. We considered literature data to perform epidemiological estimates. We then used a prevalence-based approach to calculate DALY considering current estimates of burden of disease and disability weights obtained from recent studies [19,28].

According to the results of the study, a total of 3.6 million patients potentially affected by chronic pain, corresponding to 21% of the population. The calculated prevalence of chronic pain in the adult population was 33%. These results are in the range of those reported in other countries [31]. Studies conducted in Latin American countries have reported chronic pain prevalence rates of 29–42% in Brazil [8] and 32% in Chile (excluding oncologic pain) [32]. In a systematic review that included studies from developing countries, prevalence of chronic pain is reported in the range of 13–51% with an estimate under the random effects model of 32% (95% CI 25–39%) [8]. Brazil was the only Latin American country represented in the review. In other research that included studies developed in low- and middle-income countries, the estimated prevalence of chronic pain in adults was 33% (95%CI 26–40) and 56% (95%CI 36–75) if elderly people are considered [33]. For musculoskeletal pain, the prevalence calculated in this study was 7.6%, which is below the estimated prevalence in Chile of 21.8% (95%CI 19–24) [34]. The prevalence of osteoarthritis (6.2% of the total population) is lower than the prevalence in the adult population of 10.8% [35]. This study estimated a similar prevalence of low back pain (5.5%) to the available for the Andean region of Latin America (between 4.2 and 10.12%) [36,37].

Almost 256 thousand DALYs were calculated for chronic pain. If this is compared with the estimated 4.38 million DALYs for Ecuador in the GBD of 2019, it would mean that these are 5.9% of the total. This number of DALYs would be greater than those estimated in the same study for headaches, stroke, diabetes, and chronic obstructive pulmonary disease, among others [24,28]. For cancer-related pain, the 9,635 DALYs estimated here are consistent with the 11,458 YLDs estimated for cancer in the GBD. Considering that we are estimating DALYs

Table 1. Number of cases identified and rates per 100,000 inhabitants for post-herpetic neuralgia, diabetic neuropathy, chronic low back pain, osteoarthritis, cancer-related pain, other diagnoses, and the total, distributed by five-year age groups.

	Post-herpetic neuralgia		Diabetic neuropathy		Chronic low back pain		Osteoarthritis		Cancer-related pain		Other musculoskeletal conditions		Total	
Age	N	N/100 000	N	N/100 000	N	N/100 000	N	N/100 000	N	N/100 000	N	N/100 000	N	N/100 000
0–4	0	0.00	0	0.00	0	0.00	0	0.00	329	19.81	0	0.00	329	19.81
5–9	0	0.00	0	0.00	7,443	442.61	0	0.00	402	23.92	0	0.00	7,846	466.53
10–14	0	0.00	0	0.00	33,370	1,990.80	0	0.00	543	32.39	0	0.00	33,913	2,023.19
15–19	0	0.00	1,532	95.47	55,425	3,454.27	0	0.00	650	40.54	36,662	2,284.90	94,269	5,875.18
20–24	0	0.00	2,878	192.37	63,887	4,269.97	0	0.00	676	45.21	69,038	4,614.17	136,480	9,121.72
25–29	0	0.00	4,302	312.72	70,997	5,160.55	0	0.00	832	60.50	108,683	7,899.79	184,815	13,433.56
30–34	0	0.00	5,784	456.07	74,785	5,897.05	3,302	260.37	1,240	97.81	126,125	9,945.47	211,236	16,656.78
35–39	0	0.00	7,809	667.85	81,515	6,971.10	23,408	2,001.81	1,758	150.31	128,834	11,017.83	243,324	20,808.90
40–44	10,532	1,000.00	10,008	950.20	82,152	7,800.04	57,333	5,443.56	2,030	192.77	125,494	11,915.22	287,548	27,301.79
45–49	9,285	1,000.00	13,233	1,425.15	80,055	8,621.54	95,895	10,327.54	2,522	271.64	124,231	13,379.18	325,222	35,025.04
50–54	16,280	2,000.00	17,063	2,096.12	77,865	9,565.51	130,646	16,049.62	2,757	338.75	123,336	15,151.58	367,947	45,201.58
55–59	13,993	2,000.00	21,605	3,087.93	75,276	10,759.14	157,527	22,515.08	3,261	466.10	119,990	17,150.04	391,652	55,978.29
60–64	14,358	2,500.00	23,226	4,044.07	65,040	11,324.65	154,467	26,895.46	3,712	646.29	102,015	17,762.70	362,817	63,173.18
65–69	11,217	2,500.00	23,311	5,195.63	56,401	12,570.90	140,822	31,387.15	3,705	825.77	85,030	18,952.05	320,485	71,431.51
70–74	13,716	4,100.00	21,049	6,292.09	46,531	13,909.41	117,600	35,153.70	3,540	1,058.22	66,217	19,794.00	268,652	80,307.42
75–79	9,520	4,100.00	16,011	6,895.15	35,270	15,189.23	86,676	37,327.63	2,805	1,207.84	45,375	19,540.90	195,656	84,260.76
80+	10,210	4,100.00	16,663	6,691.22	39,641	15,918.03	94,341	37,883.57	2,689	1,079.83	48,371	19,424.00	211,915	85,096.65
Total	**109,112**	**631.87**	**184,473**	**1,068.30**	**945,652**	**5,476.33**	**1,062,016**	**6,150.20**	**33,453**	**193.73**	**1,309,402**	**7,582.83**	**3,644,108**	**21,103.26**

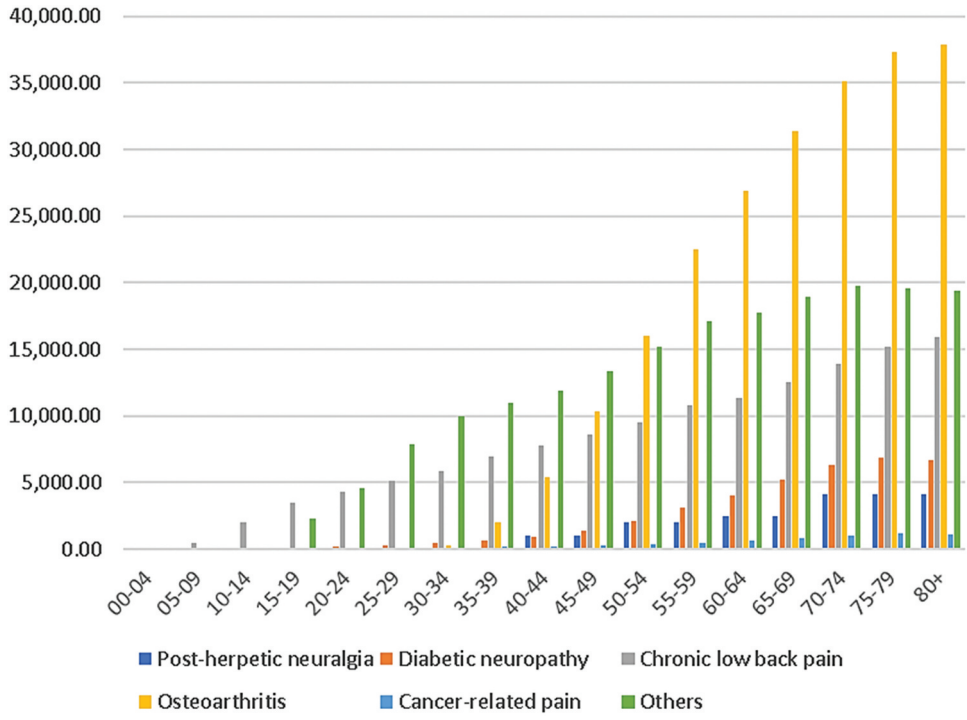

Figure 1. Rate of cases per 100,000 inhabitants for post-herpetic neuralgia, diabetic neuropathy, chronic low back pain, osteoarthritis, cancer-related pain, and other diagnoses for each age group.

related to pain, they should be less that the total DALYs related to cancer. In general, it is considered that there is a reasonable consistency between our data and those carried out in similar studies, despite using different data. For localized neuropathic pain, the burden of disease estimated in this study may be underestimated because it only included the burden attributable to post-herpetic neuralgia and diabetic neuropathy. The main limitation in estimating the burden of disease due to LNP is related to the difficulty in identifying it in local clinical practice as there is no specific diagnostic code and no standardized criteria to properly classify patients.

The estimated burden of disease for chronic pain could have a major impact not only healthcare resource use but also on lost productivity. Considering that most cases of low back pain and other musculoskeletal conditions occur in the working-age population, it is expected that these conditions have a relevant bearing on absenteeism and presenteeism [38,39] related to work. It is important to note that chronic pain patients may have productivity loss not directly related to pain but to their baseline disease (e.g. cancer). Several studies provide economic impact estimation considering the human capital approach. In a US study [40], costs related to lost productivity accounted for up to 53% of total care costs. The same study estimated that a person with moderate pain loses on average 2.1 days more work than a person without pain, a person with severe pain loses up to 4.7 days more and that pain was associated to fewer hours worked per year[42]. In studies in Ireland, Sweden, and Denmark, productivity losses accounted for 29–59% of total costs [41]. Concerning specific conditions, a study in Brazil on low back pain costs reports that 79% of the total costs correspond to lost productivity costs [42]. During the period 2012–2016, the average absenteeism per person per year due to low back pain was 83–100 days [42]. For Ecuador, there are no studies available on the economic impact associated with chronic pain, so this should be an aspect of research that should be considered in future studies, especially considering the impact of this condition in terms of disease burden.

The main strengths of this study is the application of currently accepted methods for estimating burden of disease, and the consistency of estimates with other studies*** [29,30].

Some limitations are related to epidemiological estimates. Prevalence data for causes associated with chronic pain were obtained from literature and GBD reporting as there is significant underreporting of cases from local data. In particular, the prevalence of postherpetic neuralgia and diabetic neuropathy was based on international studies as no local studies were identified. Due to the limited availability of prevalence of diabetic neuropathy by age group it was necessary to assume a proportional distribution of cases. The extrapolation of international data may also introduce error, given demographic differences between countries. It is important to mention that the demographic information we had available was from 2019, which could produce slight differences in final results considering a potentially changes in demographic profile over time. Other limitations are related to DALY estimates. For chronic low back pain and osteoarthritis, we had to weight different disutility weights considering literature data from other countries. This produces a significant source of uncertainty that is particularly important considering that they were the main producers of DALYs. For cancer estimations, the disutility weight we used was not specific to pain. As such, we could have overestimated total DALYs.

Table 2. Number of DALYs and rates per 100,000 inhabitants for post-herpetic neuralgia, diabetic neuropathy, chronic low back pain, osteoarthritis, cancer-related pain, other diagnoses and the total, distributed by five-year age groups.

	Post-herpetic neuralgia		Diabetic neuropathy		Chronic low back pain		Osteoarthritis		Cancer-related pain		Other		Total	
Age	DALY	DALY/100 000	DALY	DALY/100 000	DALY	DALY/100 000	DALY	DALY/100 000	DALY	DALY/100 000	DALY	DALY/100 000	DALY	DALY/100 000
0–4	0	0.00	0	0.00	0	0.00	0	0.00	95	5.70	0	0.00	95	5.70
5–9	0	0.00	0	0.00	833	49.53	0	0.00	116	6.89	0	0.00	949	56.42
10–14	0	0.00	0	0.00	3,734	222.77	0	0.00	156	9.33	0	0.00	3,891	232.10
15–19	0	0.00	204	12.70	6,202	386.53	0	0.00	187	11.68	843	52.55	7,436	463.46
20–24	0	0.00	383	25.59	7,149	477.81	0	0.00	195	13.02	1,588	106.13	9,314	622.54
25–29	0	0.00	572	41.59	7,945	577.47	0	0.00	240	17.43	2,500	181.70	11,256	818.18
30–34	0	0.00	769	60.66	8,368	659.88	222	17.52	357	28.17	2,901	228.75	12,618	994.98
35–39	0	0.00	1,039	88.82	9,122	780.07	1,575	134.72	506	43.29	2,963	253.41	15,205	1,300.31
40–44	1,401	133.00	1,331	126.38	9,193	872.82	3,858	366.35	585	55.52	2,886	274.05	19,254	1,828.12
45–49	1,235	133.00	1,760	189.54	8,958	964.75	6,454	695.04	726	78.23	2,857	307.72	21,991	2,368.29
50–54	2,165	266.00	2,269	278.78	8,713	1,070.38	8,792	1,080.14	794	97.56	2,837	348.49	25,571	3,141.35
55–59	1,861	266.00	2,873	410.70	8,423	1,203.95	10,602	1,515.27	939	134.24	2,760	394.45	27,458	3,924.60
60–64	1,910	332.50	3,089	537.86	7,278	1,267.23	10,396	1,810.06	1,069	186.13	2,346	408.54	26,088	4,542.33
65–69	1,492	332.50	3,100	691.02	6,311	1,406.68	9,477	2,112.36	1,067	237.82	1,956	435.90	23,403	5,216.28
70–74	1,824	545.30	2,800	836.85	5,207	1,556.46	7,914	2,365.84	1,020	304.77	1,523	455.26	20,288	6,064.48
75–79	1,266	545.30	2,129	917.05	3,947	1,699.68	5,833	2,512.15	808	347.86	1,044	449.44	15,027	6,471.48
80+	1,358	545.30	2,216	889.93	4,436	1,781.23	6,349	2,549.56	774	310.99	1,113	446.75	16,246	6,523.77
Total	**14,512**	**84.04**	**24,535**	**142.08**	**105,818**	**612.80**	**71,474**	**413.91**	**9,635**	**55.79**	**30,116**	**174.41**	**256,090**	**1,483.03**

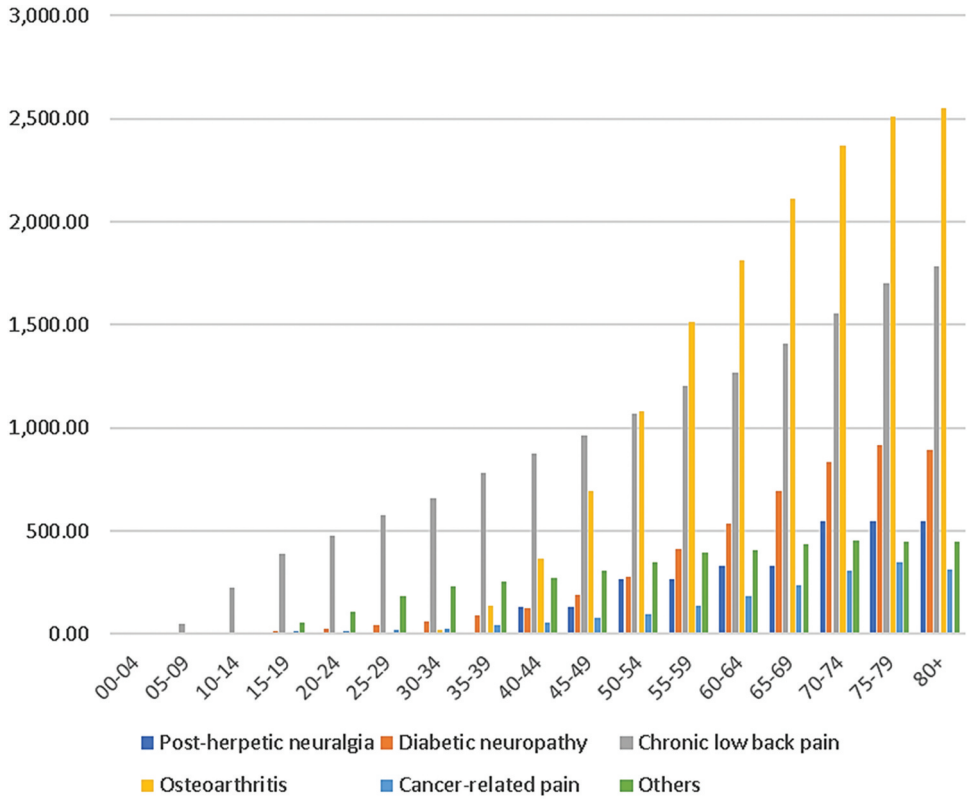

Figure 2. DALY rate per 100,000 population for post-herpetic neuralgia, diabetic neuropathy, chronic low back pain, osteoarthritis, cancer-related pain, and other diagnoses for each age group.

Calculation of the subgroup of cancer patients with chronic pain may help correct this effect. Our estimation for years lost to disability considered diseases that produce disability by factors different from pain. The disability weight we used did not allow to differentiate the source of disability. As such, we also have to consider errors introduced by this issue. It is also important to mention that our estimation refers to a single point in time. As such we cannot evaluate the time trends of chronic pain in Ecuador. Also our estimations have a descriptive nature, since no hypothesis is being statistically tested.

Despite these difficulties, this estimation provides important information for local decision makers in Ecuador.

5. Conclusions

Chronic pain produces a significant burden of disease in Ecuador. Most DALYs were related to back pain and osteoarthritis. This information can help identify public health priorities.

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Declaration of interest

P Lasalvia, Y Gil-Rojas and D Rosselli declare employment at NeuroEconomix. NeuroEconomix received funding for this project. The authors have no other relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript apart from those disclosed.

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Author contributions

P Lasalvia and Y Gil-Rojas contributed to the conception of study, data extraction, data analysis, and drafting of the manuscript and final manuscript review. D Rosselli contributed to the conception of the study and final revision of the manuscript. All authors approved the final version of the manuscript for publication.

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