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Comparison of a 30-year trend of incidence, prevalence, and DALY due to low back pain in Iran with Low- and High-SDI countries; Based on GBD study 2019 Data

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Abstract: **Introduction:** Low back pain (LBP) represents the leading cause of disability worldwide and is a major economic and welfare problem. This study aimed to report incidence, prevalence, and disability-adjusted life years (DALY) rates of LBP in Iran by gender and different sociodemographic index (SDI) countries from 1990 to 2019. **Methods:** The age-standardized LBP and incidence, prevalence, and DALY were extracted based on the Global Burden of Disease (GBD) 2019 in Iran for males and females, and low- and high-SDI countries during 1990- 2019. **Results:** GBD 2019 data for LBP in Iran indicate a significant downward trend of incidence and prevalence from 1993 to 2019 in males, females, and both, except during the 1999-2002 period for females. A sharp reduction is seen in LBP incidence and prevalence from 1996 to 1999. Gender is not a determining factor in the LBP prevalence in Iran. Regarding the SDI categories, Iran had the highest incidence rate compared to countries with low- and high SDIs. High-SDI countries had the highest prevalence and DALY compared with Iran and low-SDI countries. **Conclusion:** The age-standardized incidence and prevalence of LBP in Iran showed a downward trend, from 1993 to 2019, especially from 1996 to 1999. Comparing Iran with low- and high-SDI countries, a heavier incidence of LBP was observed in Iran and heavier prevalence and DALY were seen in high-SDI countries. Therefore, more therapeutic healthcare interventions are required to reduce the LBP burden more effectively.

Keywords: Low back pain; Global burden of disease; Incidence; Prevalence; Disability-adjusted life years

1. Introduction

Low back pain (LBP) is a common musculoskeletal condition that most individuals experience in their lifetime. LBP represents the leading cause of disability worldwide and is an economic and welfare problem [1]. Most people with activity-limiting LBP experience recurrent episodes [2]. The prevalence of acute and chronic LBP in adults doubled in the last decade and continues to increase dramatically in the aging population, affecting both men and women in all ethnic groups [1]. A study conducted based on a Global Burden of Disease (GBD) 2017 reported that LBP had the highest prevalence and was the leading reason of disability among all musculoskeletal disorders worldwide and in 2019, it caused the ninth largest burden of disease, globally [3]. There are funda-

mental reports on the prevalence of LBP that estimate point prevalence ranging from 1.0 to 58.1% (mean: 18.1%; median: 15.0%), and one-year prevalence ranging from 0.8 to 82.5% (mean: 38.1%; median: 37.4%) [2]. For the incidence, evidence has demonstrated an incidence of chronic or recurrent LBP as a musculoskeletal condition at three, six, and twelve months ranging from 35% to 79% [4]. On the other hand, the estimation of work-related LBP results in the loss of 818,000 disability-adjusted life years (DALYs) annually [5]. For example, a previous study also indicated that DALYs of LBP were 716 (95% confidence interval (CI): 558- 896) per 100,000 in Malta [6].

Due to population aging and growth, economic and physical costs related to LBP are rising in the future, thereby needing rapid healthcare system improvements, especially, in regions with poor standard living [7]. This disease is a major global health issue and much more epidemiological research can be extremely broad at the local level, allowing policymakers to be informed with current-valued, detailed data and trends over time. Therefore, providing national- and region-specific data on the burden of LBP is critical for local healthcare poli-

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cymakers [8].

Reviewing the related LBP works indicates few published studies on the long-term trend of LBP burden and its relation with socioeconomic status in world countries. For example, the burden of LBP in the Middle East and North Africa (MENA) slightly reduced from 1990 to 2019 [9]. Many studies reported a higher incidence of LBP in females, and some reports found that males were more susceptible to LBP than females [4]. In 2019, the LBP burden was globally estimated to be higher among the female population and its peak point prevalence was for those aged 80 to 84years old [8]. That research stated a weak positive correlation between socioeconomic development and LBP burden. Also, a GBD 2019 publication reported the LBP burden at the national, regional, and global levels. Moreover, two previous studies based on GBD 2010 [10] and GBD 2017 [11] data, reported the LBP burden worldwide, with no details for each country and territory. As a result, there is a requirement to research the burden of LBP at the national level compared with other countries to provide more detailed information.

Iran, as one of the developing middle-income countries in the Middle East, is populated by 87.92 million (50% are under 25 years old) with 2 million work units [12]. With such a high level of young people, a major proportion of LBP is exacerbated or accelerated through occupational conditions [13]. In terms [13]of occupational LBP, a systematic review stated that neglecting workplace ergonomics and lack of effective interventions were the main risk factors among Iranian workers [14]. Awkward posture, manual handling of loads, and repetitive and overuse work may result in a broad range of musculoskeletal conditions, particularly LBP. DALY is a standard index utilized to quantify the burden in terms of morbidity and mortality (years lived with a disability (YLD) and years of life lost (YLL)). In the burden of disease studies based on GBD, the LBP disease is assumed not to carry any mortality, therefore, estimations of the YLD index are equivalent to DALY [10].

Initial or continuing healthcare professionals' education regarding the effective management of LBP has been demonstrated to be important, especially in the context of Iran's evolving healthcare system [15]. Understanding the burden, epidemiology, and management of LBP disorder in Iran and other countries may improve our knowledge of the role of different sociocultural conditions in the progression of simple back pain to a chronic disabling condition. Furthermore, this information may increase motivation to rationalize the allocation of low available resources, thereby improving the quality of care for individuals suffering from LBP in a developing country.

The purpose of the present study was to estimate trends of prevalence, incidence, and DALYs due to a musculoskeletal disorder, categorized as LBP, across Iran from 1990 to 2019 according to gender and compared to countries with different sociodemographic index (SDI).

2. Methods

2.1. Case definition and data sources

The "low back" is defined as the area on the posterior section of a person's body, from the lower aspect of the 12th ribs to the lower gluteal folds. LBP lasts for at least 1 day without or with pain referred in one or both lower limbs [3].

For this research, the information according to the GBD free online database (GBD 2019) on incidence and prevalence of age-standardized LBP per 100,000 persons was extracted from 1990 to 2019 for males and females in Iran. International cooperative GBD is the most international cooperative epidemiological study, which includes the burden of disease indicators such as mortality, incidence, prevalence, YLD, YLL, and DALY and estimates the burden of 369 diseases and injuries for more than 200 world countries and territories by sex and age group from 1990 to the present.

Findings from the GBD data can be used by the decision-makers at the global, regional, national, and local levels to get a better understanding of health trends and improve their policy over time. More information about GBD study 2019 can be found elsewhere [3].

2.2. Parameters under study

In the current study, the inclusion criteria extracted from the GBD study 2019 were 1) cause: low back pain; 2) measures: incidence, prevalence, and DALY rates per 100,000 people, 3) location: Iran, low and high SDI countries; 3) age: age-standardized; 4) sex: female, male, and both; and 5) year: 1990-2019.

The SDI index is a composite indicator of development status strongly correlated with health outcomes. It is a geometric mean of 0 to 1 index of total fertility rate under age 25, mean education for those aged 15 years and older, and lag-distributed income per capita. As a composite, a location with an SDI of 0 would have a theoretical minimum level of development relevant to health, while a location with an SDI of 1 would have a theoretical maximum level. This index is classified into five categories Low, Low-middle, Middle, High-middle, and High with SDI values between 0.000-0.455, 0.456-0.608, 0.609-0.689, 0.690-0.805, and 0.806-1.000, respectively.

2.3. Statistical analysis

To describe the trend of epidemiological indices, the incidence and prevalence rates, by gender, and their 95% confidence/uncertainty intervals have been reported in Iran. Moreover, these indicators and DALY were reported for both genders in Iran compared with countries with low and high SDI. To assess the changes profile of the indices, the joinpoint model using the Joinpoint Program, Version 5.0.2. was used [16].

For each fitted joinpoint regression model, the Annual Percent Change (APC) for separate segments and the Average Annual Percent Change (AAPC) for the overall time interval

(1990-2019) were calculated [17]. 95% CI for AAPCs and APCs and were reported to assess the statistical significance of the estimates.

3. Results

In the present study, the burden of LBP for Iran, and high and low SDI countries was extracted based on gender from 1990 to 2019. The descriptive statistics for LBP incidence and prevalence in Iran by gender in 1990, 1995, 2000, 2005, 2010, 2015, and 2019 are shown in Table 1 and the joinpoint regression model output for estimation of LBP incidence and prevalence trends in Iran between 1990 and 2019 for males, females, and both are indicated in tables 2 and 3. In addition, figures 1 and 2 display the trend of these indices in Iran during the study period. Figure 3 displays the trend of the DALY index based on gender in Iran during the study period.

Table 4 includes the descriptive statistics for LBP incidence, prevalence, and DALY in three country classifications including Iran and countries with low and high SDI in 1990, 1995, 2000, 2005, 2010, 2015, and 2019. Table 5 indicates the joinpoint regression model output of these indices' trend estimation in three country classifications between 1990 and 2019. In addition, figures 4, 5, and 6 display the trend of these indices in these countries during the study period.

3.1. Incidence, prevalence, and DALY indices in Iran based on gender

In a glance at figure 1 and table 2 on the incidence, a non-significant APC is observed in the first interval with a very slight increase in males, females, and both populations. However, in the second period, a significant reduction is observed for men, women, and both (p<0.05). Among all periods, the maximum reduction can be seen in the third period (1996- 1999) for males and both, especially for males with an APC of -2.65 per 100, 000 population (p<0.05). For females, the maximum reduction was in the second period (1993- 1996) with an APC of -0.60 per 100, 000 population. Also, for the fourth (1999- 2002) and fifth (2002- 2019) periods, a significant decrease in APC was found for males (APC: -0.39 and -0.09) and both (APC: -0.35 and -0.106) populations (p<0.05). Finally, AAPC shows a significant reduction for all males (-0.39), females (-0.176), and both (-0.299) populations, with a greater decrease in males (p<0.05 for the three trends).

The fitted joinpoint regression model of prevalence in Iran (table 3 and figure 2) shows almost similar behavior to the results of the fitted model of incidence data, but different in that there were no trends in the fourth and fifth (2002-2019) periods for both populations. In a glance at figure 2, another interesting point is that at the ending point of the study, all populations reached almost one point in the trend of LBP prevalence indices, for males: 9535.56 to 7496.37, for females: 9575.27 to 7564.26, and both: 9528.30 to 7533.78. Finally, AAPC shows a significant reduction for all males (-0.44), females (-0.22), and both (-0.35) populations (p<0.05

for the three trends), with a greater decrease in males. For the DALY, the trends were almost the same as the prevalence, as presented in figure 2. A comparison of the prevalence, incidence, and DALY in men and women was conducted and the results indicated a significant difference between these three indicators in men and women both in terms of being parallel and in terms of being coincident (p<0.05 in all six comparisons).

3.2. Comparison of Iran with countries of low and high SDI

In a glance at figures 4, 5, and 6, Iran has experienced higher rates of incidence than both countries of low and high SDI from 1990 to 2019, while rates of prevalence and DALY in Iran were between low and high SDI countries. Also, we can generally see that all significant APCs of the three country classifications in incidence, prevalence, and DALY indices had a decreasing trend. The detailed results of these indices based on the three country classifications are hereby presented:

Incidence

Regarding the estimates for incidence rates, we can observe six joinpoints for low SDI and five for Iran and high SDI. For low SDI, significant annual percent changes of 0.12, 0.21, 1.16, -0.29, and 0.1 in incidence rates, respectively, in the time intervals of 1990- 1993, 1993- 1996, 1996- 1999, 2008-2015, and 2015- 2019. For Iran, significant annual percent changes of -0.25, -1.75, -0.35, and -0.106 in incidence rates, respectively in the time intervals of 1993- 1996, 1996- 1999, 1999- 2002, and 2002- 2019. As for high SDI, significant changes were -0.27 and -0.41, respectively in the periods 1990- 1999 and 2005- 2014 (p<0.05).

Therefore, the maximum reduction of incidence APC can be seen in the third period (1996- 1999) for low SDI (1.16), Iran (1.75), and high SDI (0.41) per 100,000 population, with the most reduction for Iran (p<0.05). Also, AAPC shows a significant reduction for low SDI (-0.22), Iran (-0.299), and high SDI (-0.299) countries, with the same decrease in Iran and high SDI (p<0.05 for the three trends).

Prevalence

Concerning the estimates for the prevalence, it can be observed that there are six joinpoints for countries with low SDI, three for Iran, and five for high SDI. The estimated APCs show significant annual percent changes of -0.15, 0.23, 1.43, and 0.31, in prevalence rates for low SDI, respectively, in the segments of 1990- 1993, 1993- 1996, 1996- 1999, and 2008- 2015. In the segments of 1999- 2008 and 2015- 2019, annual percent changes of -0.04 and -0.11, respectively, were not significant for low SDI. For Iran, the estimated APCs were significantly reduced by -1.59 and -0.12, respectively, in the time intervals of 1995- 2000 and 2000- 2019. Non-significant APC of Iran (0.06) was found in the first interval (1990- 1995) with a very mild reduction in the prevalence rate. For high SDI, APCs demonstrate significant annual percent changes of -0.84, -0.36, -0.35, and -0.88, respectively in the segments of 1990-1994, 1994- 1998, 2007- 2017, and 2017- 2019. Of note, the

only non-significant APC (-0.08) on low SDI is for the third interval (1998- 2007) with a very mild reduction in the prevalence rate. Therefore, the maximum reduction of prevalence APC can be seen in the third period (2008- 2015) for low SDI (1.43), in the second period (1995- 2000) for Iran (1.59), and in the fifth period (2017- 2019) for high SDI (0.88) per 100, 000 population, with the most reduction for Iran. Also, AAPC shows a significant reduction for low SDI (-0.26), Iran (-0.35), and high SDI (-0.37) countries, with a higher decrease in high SDI ($p<0.05$ for the three trends).

DALY

In terms of the estimates for the DALY, the number of join-points was the same as the prevalence. Also, DALY rates based on the fitted joinpoint regression model indicated similar behavior with the findings of the fitted model to prevalence data, but different in that Iran APC reached a significant reduction of -0.09 in the first period (1990- 1995). Like the prevalence, maximum reduction of DALY APC can be observed in the third period (1996- 1999) for low SDI (1.42), in the second period (1995- 2000) for Iran (1.60), and in the fifth period (2017- 2019) for high SDI (0.96) per 100, 000 population, with the most reduction for Iran. Moreover, AAPC shows a significant reduction for low SDI (-0.24), Iran (-0.34), and high SDI (-0.38) countries ($p<0.05$ for the three trends), with a higher decrease in high SDI.

4. Discussion

LBP is one of the most common presenting complaints globally and a serious concern among the population of working age. The present study presents up-to-date prevalence, incidence, and DALY related to LBP from 1990 to 2019 in Iran and low and high SDI countries extracted from GBD 2019.

LBP incidence and prevalence in Iran indicate a significant downward trend between 1993 and 2019 in males, females, and both, except during the 1999- 2002 period for females indicating a non-significant change. To the best of our knowledge, no study has focused on the long-term trend of LBP burden indices based on gender in Iran. The decrement in incidence and prevalence may be related to the increase in the termination rate following diagnosis and treatment of LBP in Iran. Generally, people's education about their healthy lifestyle, more global accessibility to essential medication to control risk factors of LBP, and improvement of prevention strategies for this disease may be considered as the most main causes for the decreasing trend of LBP incidence and prevalence.

As shown in figures 1 and 2, a sharp reduction is seen in LBP incidence and prevalence in Iran during 1996- 1999 with the most reduction in males. Differences in the definition of LBP [18, [19] during these years may have affected the rates of incidence/prevalence of this disease in Iran. On the other hand, during these years, the reduction for men was more than women. Many investigations showed a strong correlation between features of occupations and LBP [20, [21, [22, [23]. So, a possible reason for our results could be that

women's preference was to work outside the home after 1996 [24, [25]. Since stress at work could be one of the culprits of chronic LBP [26], men felt less work-related pressure on their backs after 1996 than before, thereby decreasing the occurrence of LBP. Another finding regarding LBP is that in the ending point of the study, all populations reached almost one point in the trend of LBP prevalence indices. Mousavi et al. (2011) stated that LBP is a major cause of disease burden in Iran, particularly, in the most productive age for both genders [27]. The results of a previous study have indicated that the global burden of LBP was higher among females than males in almost all age groups, although the differences in the prevalence rate were not statistically significant [8]. Some other studies reported that prevalence in male individuals was lower than females [11, [28]. It should be emphasized that the present work uniquely focused on Iran, based on gender. A systematic review reported that gender was not associated with LBP prevalence in Iran [15]. Therefore, according to our findings, gender is not a determining factor in the prevalence of LBP in Iran.

Despite our knowledge of the substantial effects of LBP on mortality and global disability, published research in this area has not sufficiently focused on the role of geographical location. According to our findings from the GBD study 2019, a downward trend can be seen in incidence, prevalence, and DALY in this period (1990-2019) for Iran, low and high SDI countries. These reductions may be due to the implementation of the program to prevent LBP or to manage LBP appropriately in the world. Thus, these programs should be continued. On the other hand, the reduction of these indices in the time interval between1993 to 2019 has occurred much faster in countries with low SDI compared to those with high SDI and Iran. In a study by Safiri et al. (2023), they reported that although there were inter-country differences in the change of the LBP burden during the measurement period, the burden attributable to LBP in the Middle East and North Africa (MENA) region decreased slightly in all countries from 1990 to 2019 [9]. Therefore, policymakers should initiate prevention programs on LBP at early ages, particularly in high prevalence and incidence countries, to decrease the LBP incidence in the next decades of their lives.

Based on figure 4, Iran had the highest incidence rate compared to countries with low and high SDIs, which highlights the requirement for more research to investigate causes (e.g. occupational exposures) of this result. In terms of occupational LBP, a systematic review stated that neglecting workplace ergonomics and a lack of effective interventions were the main risk factors among Iranian workers [14]. Consequently, the higher incidence in Iran may be due to the higher prevalence of associated risk factors in this country.

Based on figures 5 and 6, countries with high SDI had the highest prevalence and DALY compared with Iran and countries with low SDI. The results from a study (2021) suggest that prevalent cases of LBP by region changed from 1990 to 2017: (lowest: 21.6% in East Asia and highest: 59.7% in Cen-

tral Europe) [29]. Previous studies also reported that LBP prevalence increases with age, peaking at the age of 85 years, and compromises the prospect of healthy aging [9, [30, [31]. Thus, a reason for the increment of LBP prevalence in high SDI countries may be that population aging is more in most of these countries, thereby resulting in more prevalence and disability of LBP among older people aged 80–85 years. On the other hand, the DALY for these countries was higher than Iran and low SDI countries. A study by Chang et al. based on GBD data 2017 reported that adults in countries with low SDI still experience a higher burden of age-associated disorders such as musculoskeletal ones [32]. Another study showed that the age-standardized rate of LBP DALY was much higher in regions with high values of SDI than in ones with other values of SDI [31]. Considering that the life expectancy in high SDI countries is high and people have a longer lifespan, therefore, if they suffer from LBP, they will live with this disease for more years.

4.1. Limitations

The current research is the first to estimate the LBP burden in Iran by gender and compared with low and high SDIs, based on the most recent GBD data. However, our research has some limitations that should be addressed when interpreting the results. Firstly, the GBD presents modeled estimations instead of primary data. Secondly, the use of different definitions in LBP and the lack of a proper survey for data collection on the LBP burden in many countries is another limitation of GBD data. Thirdly, we just reported the patterns of LBP by gender for Iran, but there are other factors associated with the LBP, that were not included in the current study, such as religion, occupation, social capital, education, race/ethnicity, culture, and language [33]. Thus, reporting the LBP burden by culture, religion, and race/ethnicity needs to be considered in future GBD studies.

5. Conclusions

The global age-standardized incidence, prevalence, and DALY of LBP in Iran showed a downward trend, especially in the time interval between 1996- 1999. Comparing Iran with low- and high-SDI countries, a higher incidence of LBP was observed in Iran and higher prevalence and DALY was observed in countries with high SDI. Therefore, more therapeutic healthcare interventions are required to more effectively reduce the LBP burden in these regions.

6. Declarations

6.1. Acknowledgments

None.

6.2. Conflict of interest

The authors declare no conflict of interest.

6.3. Funding

There was no funding for this research

6.4. Authors' contribution

Conceptualization: Alireza Akbarzadeh Baghban; Methodology: Alireza Akbarzadeh Baghban and Aliyeh Daryabor; Investigation: Aliyeh Daryabor; Statistical Analysis: Alireza Akbarzadeh Baghban; Writing-original draft: Aliyeh Daryabor and Alireza Akbarzadeh Baghban; Writing-review, and editing: Aliyeh Daryabor and Alireza Akbarzadeh Baghban

6.5. Ethical considerations

This research was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences (Ethics Code: IR.SBMU.RETECH.REC.1402.326).

6.6. Consent for publication

We have utilized the public "Global Burden of Disease Study" database according to the proposed format of the "Institute for Health Metrics and Evaluation" (IHME).

6.7. Data Availability

The authors guarantee that data from the study are available and will be provided if anyone needs them.

6.8. Using artificial intelligence chatbots

None.

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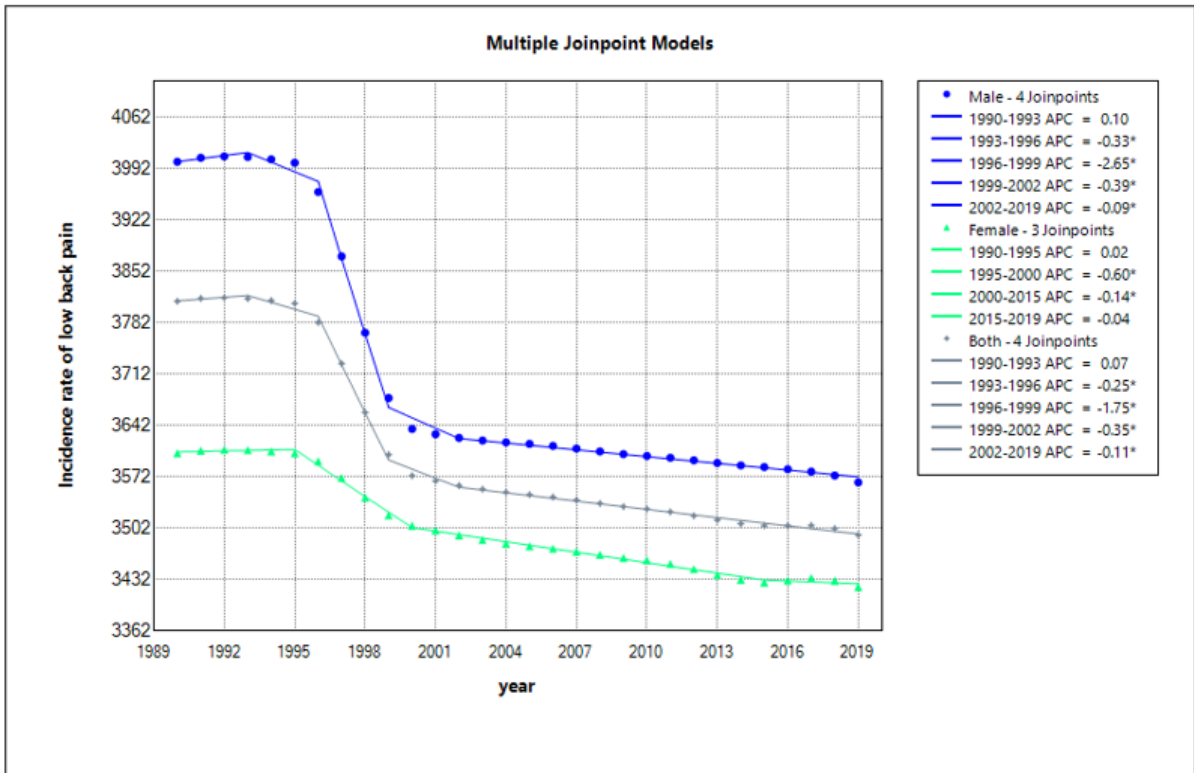
Figure 1: Trend of low back pain incidence in Iran by gender from 1990 to 2019.
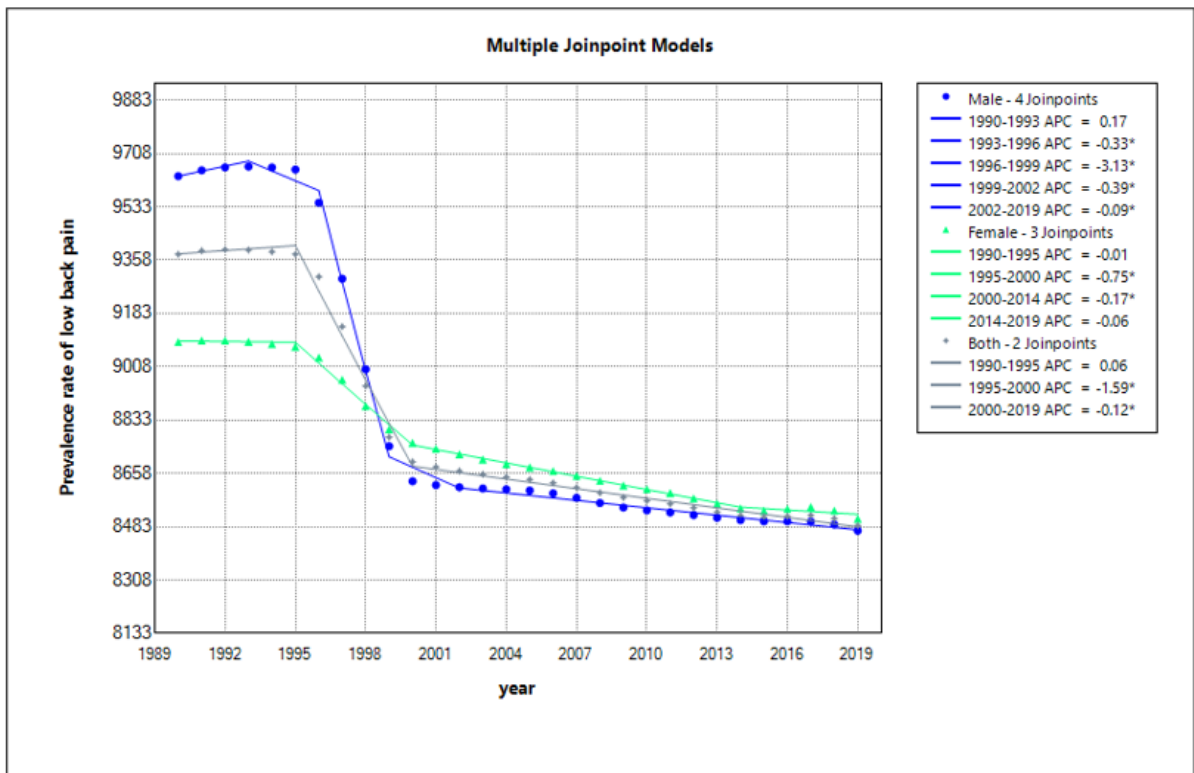

Figure 2: Trend of low back pain prevalence in Iran by gender from 1990 to 2019.
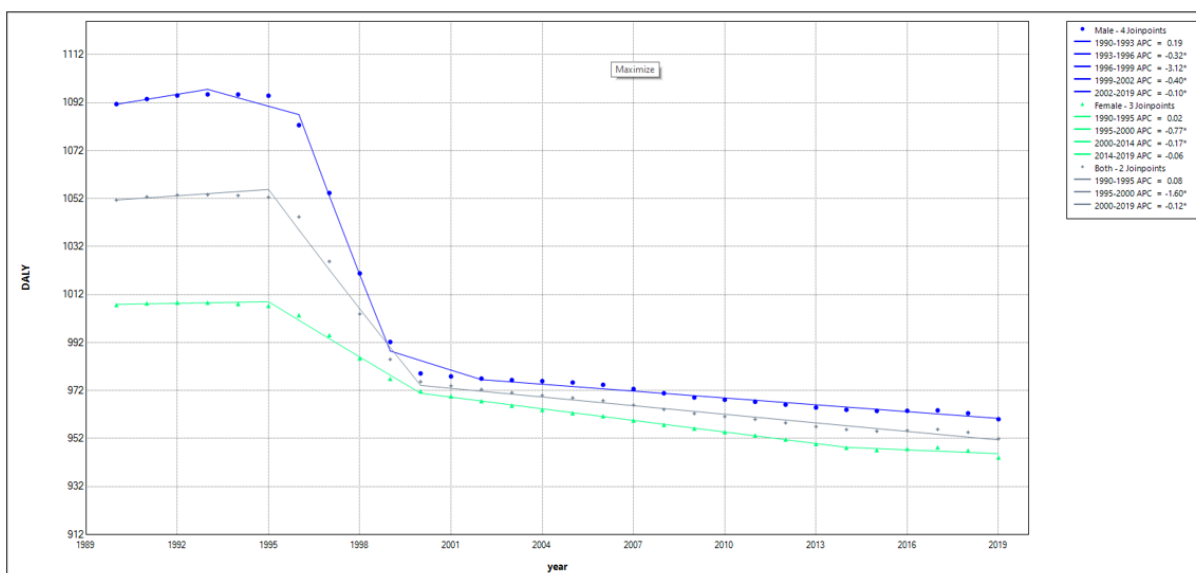
Figure 3: Trend of low back pain disability-adjusted life years (DALY) in Iran by gender from 1990 to 2019.

Table 1: Age-standardized Incidence and prevalence rate per 100,000 (95% UI) of LBP in Iran for selected years of males, females, and both from the GBD database

Gender	1990	1995	2000	2005	2010	2015	2019
Incidence							
Males	4001.19 (3544.92, 4522.41)	3999.79 (3538.44, 4523.19)	3637.34 (3213.45, 4109.78)	3617.01 (3191.83, 4088.58)	3600.55 (3190.19, 4066.42)	3585.39 (3166.65, 4051.50)	3564.55 (3148.31, 4039.62)
Females	3604.40 (3186.75, 4052.63)	3604.40 (3193.28, 4058.32)	3505.76 (3100.35, 3940.45)	3477.56 (3078.30, 3924.28)	3458.40 (3058.52, 3891.72)	3428.28 (3037.91, 3867.69)	3422.09 (3024.54, 3862.08)
Both	3811.26 (3375.48, 4287.97)	3808.30 (3372.50, 4290.69)	3573.62 (3165.05, 4025.77)	3547.89 (3142.77, 4000.58)	3528.24 (3123.16, 3973.29)	3505.57 (3100.12, 3947.88)	3492.98 (3092.55, 3949.54)
Prevalence							
Males	9633.42 (8515.47, 10852.14)	9655.03 (8550.63, 10887.36)	8631.97 (7628.04, 9699.74)	8601.64 (7588.21, 9711.83)	8536.31 (7565.69, 9584.22)	8500.40 (7549.88, 9562.27)	8469.98 (7496.37, 9535.56)
Females	9089.00 (8033.88, 10286.40)	9073.66 (8033.21, 10242.81)	8758.20 (7756.41, 9912.45)	8677.70 (7670.17, 9808.54)	8606.44 (7602.97, 9717.38)	8535.19 (7543.25, 9636.66)	8508.58 (7564.26, 9575.27)
Both	9377.05 (8310.75, 10579.11)	9376.84 (8296.43, 10585.29)	8695.47 (7719.93, 9801.07)	8637.74 (7637.98, 9738.01)	8567.76 (7596.95, 9632.02)	8513.95 (7536.23, 9564.59)	8486.51 (7533.78, 9528.30)

UI: uncertainty interval; LBP: low back pain, GBD: Global Burden of Disease.

Table 2: The joinpoint regression model output of LBP incidence in Iran between 1990 and 2019 for males, females, and both based on the GBD database

Segments	Males (4 joinpoints)		Females (3 joinpoints)		Both (4 joinpoints)	
	TI	APC (95% CI)	TI	APC (95% CI)	TI	APC (95% CI)
Trend1	1990- 1993	0.10 (-0.008, 0.39)	1990- 1995	0.02 (-0.03, 0.07)	1990- 1993	0.06 (-0.007, 0.24)
Trend2	1993- 1996	-0.33* (-0.47, -0.21)	1995- 2000	-0.60* (-0.68, -0.54)	1993- 1996	-0.25* (-0.33, -0.16)
Trend3	1996- 1999	-2.65* (-2.77, -2.52)	2000- 2015	-0.14* (-0.22, -0.13)	1996- 1999	-1.75* (-1.83, -1.68)
Trend4	1999- 2002	-0.39* (-0.46, -0.21)	2015- 2019	-0.04 (-0.12, 0.09)	1999- 2002	-0.35* (-0.40, -0.25)
Trend5	2002- 2019	-0.09* (-0.10, -0.07)	-	-	2002- 2019	-0.106* (-0.115, -0.095)
AAPC	1990- 2019	-0.39* (-0.40, -0.38)	1990- 2019	-0.176* (-0.185, -0.168)	1990- 2019	-0.299* (-0.305, -0.291)

* Significant at 0.05 level. APC: Annual Percent Change; AAPC: Average Annual Percent Change; CI: confidence interval;
TI: time interval; GBD: Global Burden of Disease; LBP: low back pain.

Table 3: The joinpoint regression model output of LBP prevalence in Iran between 1990 and 2019 for males, females, and both based on the GBD database

Segments	Males (4 joinpoints)		Females (3 joinpoints)		Both (4 joinpoints)	
	TI	APC (95% CI)	TI	APC (95% CI)	TI	APC (95% CI)
Trend1	1990- 1993	0.17 (-0.08, 0.51)	1990- 1995	-0.009 (-0.05, 0.03)	1990- 1995	0.06 (-0.03, 0.15)
Trend2	1993- 1996	-0.33* (-3.22, -0.18)	1995- 2000	-0.75* (-0.78, -0.72)	1995- 2000	-1.59* (-1.65, -1.52)
Trend3	1996-1999	-3.13* (-3.30, -0.37)	2000- 2014	-0.17* (-0.18, -0.16)	2000- 2019	-0.12* (-0.14, -0.11)
Trend4	1999- 2002	-0.39* (-0.49, -0.07)	2014- 2019	-0.05 (-0.10, 0.04)	-	-
Trend5	2002- 2019	-0.09* (-0.12, -0.06)	-	-	-	-
AAPC	1990- 2019	-0.44* (-0.46, -0.42)	1990- 2019	-0.22* (-0.23, -0.21)	1990- 2019	-0.35* (-0.36, -0.33)

* Significant at 0.05 level. APC: Annual Percent Change; AAPC: Average Annual Percent Change; CI: confidence interval;
TI: time interval; GBD: Global Burden of Disease; LBP: low back pain.

Table 4: Age-standardized Incidence, prevalence, and DALY rate per 100,000 (95% UI) of LBP in low SDI, Iran, and high SDI for selected years from the GBD database

Location	1990	1995	2000	2005	2010	2015	2019
Incidence							
Low SDI	2897.01 (2560.53, 3275.82)	2900.27 (2566.43, 3277.66)	2783.85 (2466.86, 3150.26)	2789.68 (2468.34, 3162.58)	2768.79 (2447.82, 3131.70)	2727.17 (2414.80, 3088.33)	2716.93 (2399.76, 3077.63)
Iran	3811.26 (3375.48, 4287.97)	3808.30 (3372.50, 4290.69)	3573.62 (3165.05, 4025.77)	3547.89 (3142.77, 4000.58)	3528.24 (3123.16, 3973.29)	3505.57 (3100.12, 3947.88)	3492.98 (3092.55, 3949.54)
High SDI	3296.06 (2916.60, 3707.26)	3251.17 (2883.57, 3656.32)	3210.22 (2868.24, 3590.07)	3206.91 (2867.54, 3585.89)	3136.74 (2801.22, 3505.97)	3093.65 (2764.97, 3457.59)	3126.59 (2774.58, 3503.11)
prevalence							
Low SDI	6852.54 (6055.04, 7753.66)	6866.56 (6062.80, 7771.67)	6530.58 (5768.76, 7375.58)	6541.84 (5782.58, 7373.20)	6491.93 (5750.67, 7328.58)	6383.85 (5644.89, 7202.74)	6356.64 (5613.66, 7185.04)
Iran	9377.05 (8310.75, 10579.11)	9376.84 (8296.43, 10585.29)	8695.47 (7719.93, 9801.07)	8637.74 (7637.98, 9738.01)	8567.76 (7596.95, 9632.02)	8513.95 (7536.23, 9564.59)	8486.51 (7533.78, 9528.30)
High SDI	11381.99 (10145.44, 12783.94)	10955.33 (9825.79, 12282.81)	10810.91 (9822.94, 11950.08)	10791.14 (9824.99, 11945.59)	10667.92 (9718.52, 11753.58)	10450.65 (9504.65, 11544.17)	10206.20 (9208.33, 11345.23)
DALY							
Low SDI	758.02 (536.76, 1011.19)	759.29 (535.63, 1006.91)	722.43 (511.67, 962.31)	724.63 (513.09, 963.82)	720.81 (509.25, 962.71)	709.93 (501.65, 948.57)	707.05 (499.26, 942.61)
Iran	1051.42 (738.49, 1404.53)	1052.59 (738.14, 1411.46)	975.67 (686.30, 1307.44)	968.95 (682.77, 1294.88)	961.17 (673.57, 1288.57)	955.05 (669.97, 1276.76)	951.92 (668.92, 1275.17)
High SDI	1277.35 (901.92, 1722.03)	1231.35 (868.64, 1653.49)	1214.69 (862.04, 1619.35)	1212.70 (862.47, 1611.69)	1198.42 (851.54, 1592.59)	1172.61 (833.17, 1558.04)	1142.67 (809.85, 1522.54)

DALY: disability-adjusted life years; LBP: low back pain; SDI: sociodemographic index; UI: uncertainty interval;
GBD: Global Burden of Disease.

Table 5: The joinpoint regression model output for incidence, prevalence, and DALY trend analysis of LBP in Iran, and low and high SDI countries between 1990 and 2019 based on the GBD database

Segments	Low SDI		Iran		High SDI)	
Incidence						
Trend1	1990- 1993	0.12* (0.02, 0.27)	1990- 1993	0.06 (-0.007, 0.24)	1990- 1999	-0.27* (-0.32, -0.24)
Trend2	1993- 1996	-0.21* (-0.34, -0.11)	1993- 1996	-0.25* (-0.33, -0.16)	1999- 2005	-0.04 (0-0.22, 0.07
Trend3	1996- 1999	-1.16* (-1.24, -1.04)	1996- 1999	-1.75* (-1.83, -1.68)	2005- 2014	-0.41* (-0.46, -0.04)
Trend4	1999- 2008	-0.03 (-0.06, 0.006)	1999- 2002	-0.35* (-0.40, -0.25)	2014- 2017	0.40 (-0.41, 0.48)
Trend5	2008- 2015	-0.29 (-0.40, -0.25)	2002- 2019	-0.106* (-0.115, -0.095)	2017-2019	0.03 (-0.14, 0.28)
Trend6	2015- 2019	-0.10 (-0.19, 0.07)	-	-	-	-
AAPC	1990- 2019	-0.22* (-0.23, -0.21)	1990- 2019	-0.299* (-0.305, -0.291)	1990- 2019	-0.299* (-0.305, -0.291)
Prevalence						
Trend1	1990- 1993	0.15* (0.05, 0.33)	1990- 1995	0.06 (-0.03, 0.15)	1990- 1994	-0.84* (-1.05, -0.73)
Trend2	1993- 1996	-0.23* (-0.35, -0.12)	1995- 2000	-1.59* (-1.65, -1.52)	1994- 1998	-0.36* (-0.55, -0.16)
Trend3	1996- 1999	-1.43* (-1.52, -1.33)	2000- 2019	-0.12* (-0.14, -0.11)	1998- 2007	-0.08 (-0.12, 0.06)
Trend4	1999- 2008	-0.04 (-0.07, 0.002)	-	-	2007- 2017	-0.35* (-0.38, -0.31)
Trend5	2008- 2015	-0.31* (-0.44, -0.27)	-	-	2017- 2019	-0.88* (-1.08, -0.66)
Trend6	2015- 2019	-0.11 (-0.21, 0.07)	-	-	-	-
AAPC	1990- 2019	-0.26* (-0.27, -0.25)	1990- 2019	-0.35* (-0.36, -0.33)	1990- 2019	-0.37* (-0.38, -0.36)
DALY						
Trend1	1990- 1993	0.14* (0.05, 0.31)	1990- 1995	0.09* (0.0005, 0.18	1990- 1994	-0.81* (-0.99, -0.71)
Trend2	1993- 1996	-0.23* (-0.33, -0.13)	1995- 2000	-1.60* (-1.66, -1.54)	1994- 1999	-0.31* (-0.48, -0.20)
Trend3	1996- 1999	-1.42* (-1.50, -1.34)	2000- 2019	-0.12* (-0.14, -0.11)	1999- 2007	-0.006 (-0.10, 0.05)
Trend4	1999-2009	-0.02 (-0.04, 0.01)	-	-	2007- 2017	-0.37* (-0.40, -0.34)
Trend5	2009- 2015	-0.31* (-0.42, -0.26)	-	-	2017- 2019	-0.96* (-1.13, -0.73)
Trend6	2015- 2019	-0.10 (-0.18, 0.05)	-	-	-	-
AAPC	1990- 2019	-0.24* (-0.25, -0.23)	1990- 2019	-0.34* (-0.36, -0.33)	1990- 2019	-0.38* (-0.39, -0.37)

* Significant at 0.05 level, TI: time interval; CI: confidence interval; DALY: disability-adjusted life years; LBP: low back pain; SDI: sociodemographic index; GBD: Global Burden of Disease; APC: Annual Percent Change; AAPC: Average Annual Percent Change.
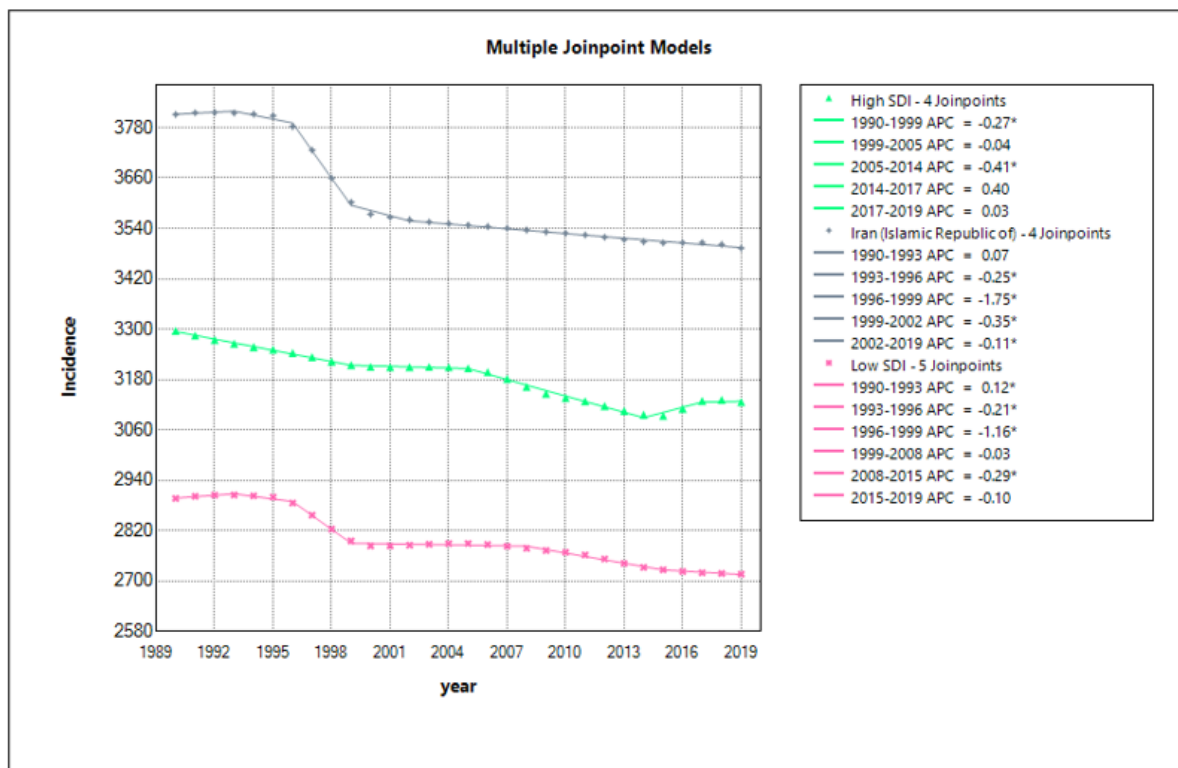

Figure 4: Trend of low back pain incidence in Iran and low and high sociodemographic index (SDI) countries from 1990 to 2019.
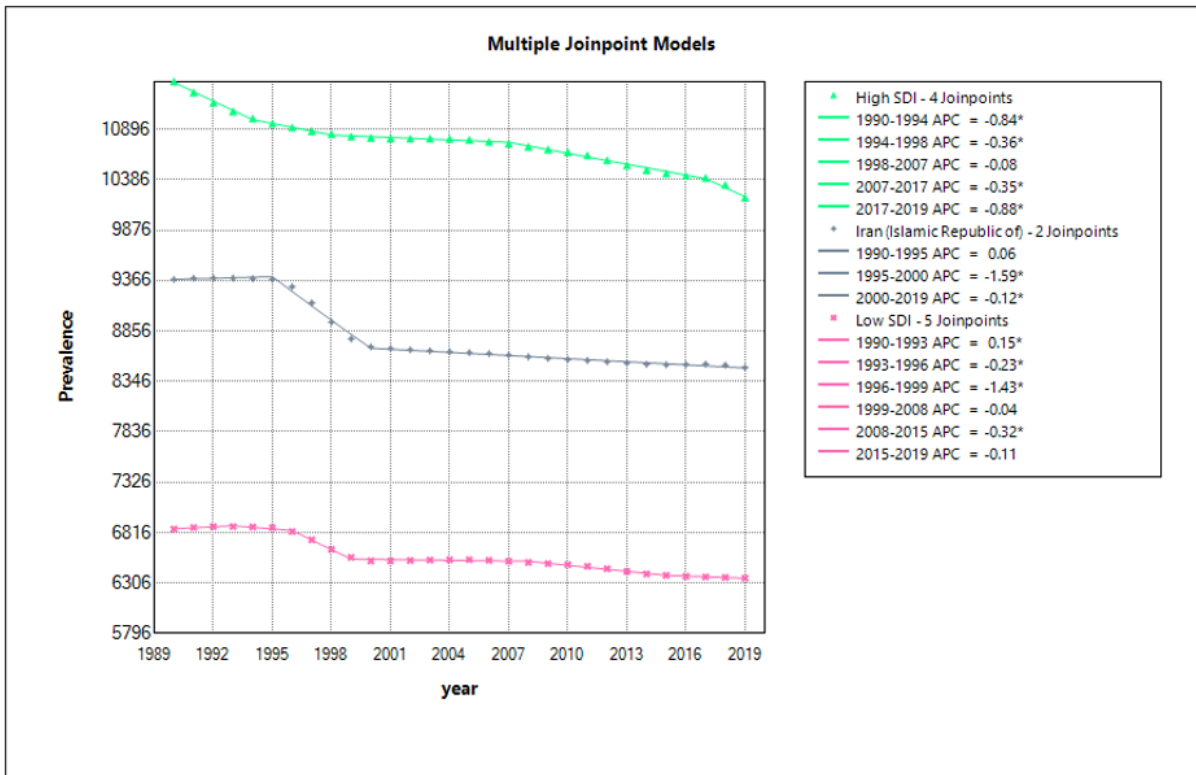
Figure 5: Trend of low back pain prevalence in Iran and low and high sociodemographic index (SDI) countries from 1990 to 2019.
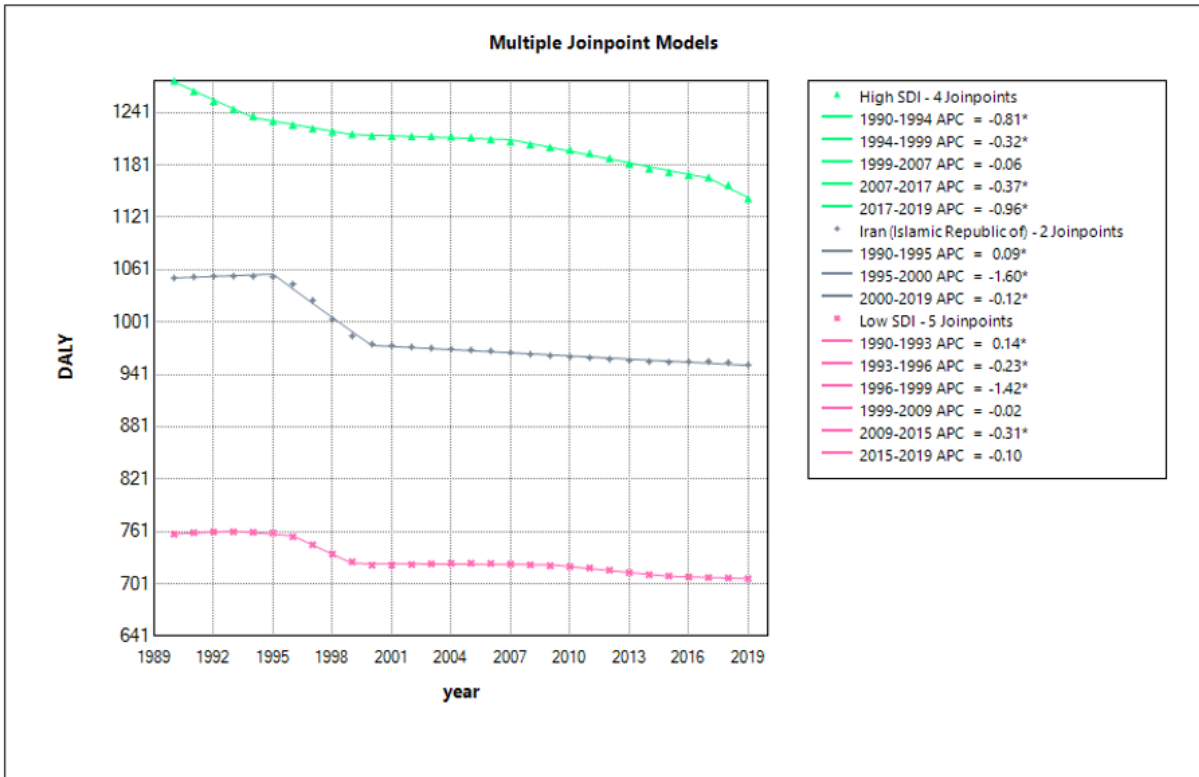

Figure 6: Trend of low back pain disability-adjusted life years (DALY) in Iran and low and high sociodemographic index (SDI) countries from 1990 to 2019.