Original Article

The Effect of Smoking on Health-Related Quality of Life (HRQoL) in Adult Patients of Arthritis

Raed Abdullah Alharbi

E.mail: r.abdullah@mu.edu.sa

Department of Public Health, College of Applied Medical Sciences,
Majmaah University, PO Box 7921,
Majmaah 11952, Saudi Arabia

Received on 30.06.2019, accepted for publication on 15.09.2019

Abstract

Background & Aims: Arthritis is an inflammation infects any joint of the body or tissues around that joint. As any disease, arthritis has an effect on health-related quality of life (HRQoL) in adult patients. Although many researches showed how smoking can worse the condition of arthritis as a disease, there is not a specific study investigated the effect of smoking on HRQoL in adult patients of arthritis, which is the goal of this study.

Methods: This study used a publicly open data source from the 2017-Behavioral Risk Factor Surveillance System (BRFSS) in the United States. It is a health survey using the telephone in order to collect data from the United States residents. There were 450,013 participants in this survey. Different descriptive, inferential, and predictive analysis methods were used by the Statistical Analysis System (9.4 version) to achieve the goal of this study. Results: There were 450,013 participants in 2017-BRFSS, 147,288 of them were adult patients of arthritis. 63,466 of these participants in BRFSS-2017 were current smokers. 13,542 of these smokers were adults patients of arthritis.

Results: this study showed a statistically significant effect of the association between arthritis and smoking on activity limitations, physical health problems, and mental health problems.

Conclusion: Smoking has a great effect on health-related quality of life (HRQOL) in adult patients of arthritis. Smoking increased each of the activity limitations in adult patients of arthritis by 164%, physical health problems by 34.75%, mental health problems by 20.58% in adult patients of arthritis.

Keywords: Arthritis; Smoking; HRQoL; BRFSS; SAS Analysis.

الملخص:

الخلفية والأهداف: التهاب المفاصل هو التهاب يصيب أي مفصل في الجسم أو الأنسجة حول هذا المفصل. مثل أي مرض، التهاب المفاصل له تأثير على جودة الحياة الصحية للمرضى البالغين. بالرغم ان بعض الدراسات أظهرت كيفية تأثير التدخين على زيادة سوء التهاب المفاصل كمرض، فإنه لا توجد دراسة محددة حققت في تأثير التدخين على جودة الحياة الصحية للمرضى البالغين المصابين بالتهاب المفاصل وهذا هو الهدف من هذه الدراسة.

طريقة البحث: استخدمت هذه الدراسة مصدر بيانات متوفر للعامة من نظام مراقبة عوامل الخطر السلوكية لعام ٢٠١٧ في الولايات المتحدة الأمريكية والتي هي عباره عن استبيان صحي باستخدام الهاتف من أجل جمع البيانات من سكان الولايات المتحدة. كان هناك ٤٥٠,٠١٣ مشارك في هذا الاستبيان. تم استخدام طرق التحليل الوصفي والاستدلالي والتنبئي المختلفة بواسطة نظام التحليل الإحصائي (الإصدار ٩.٤) لتحقيق هدف هذه الدراسة. النتائج: كان هناك ٤٥٠,٠١٣ مشارك في هذا الاستبيان ١٤٧,٢٨٨ منهم مرضى بالغين يعانون من التهاب المفاصل. ٦٣,٤٦٦ من هؤلاء المشاركين في الاستبيان كانوا مدخنين حاليين. وكان ١٣,٥٤٢ من هؤلاء المدخنين مرضى بالغين يعانون من التهاب المفاصل. أظهرت نتائج هذه الدراسة وجود تأثير ذو دلالة إحصائية للعلاقة بين التهاب المفاصل والتدخين على قصور النشاط، ومشاكل الصحة البدنية، ومشاكل الصحة العقلية لهؤلاء المرضى.

الخلاصة: التدخين له تأثير كبير على جودة الحياة الصحية لمرضى التهاب المفاصل البالغين. زاد التدخين من قصور النشاط لدى مرضى التهاب المفاصل البالغين بنسبة ١٦٤٪، ومشاكل الصحة البدنية بنسبة ٣٤.٧٥ ٪، ومشاكل الصحة العقلية بنسبة ٢٠.٥٨ ٪ في المرضى البالغين المصابين بالتهاب المفاصل.

Introduction

Arthritis, in general, is an inflammation infects any joint of the body or tissues around that joint. More than 100 kinds of arthritis can infect the human body. Some of these kinds infect only joints while other kinds can infect the immune system or other internal organs of the human body. [1,2]

However, the most common types of arthri-

tis in the United States include osteoarthritis, rheumatoid arthritis, fibromyalgia, and gout. Common symptoms of arthritis may include pain, reduction in motion, stiffness, redness, and swelling. [1,2]

According to the Centers for Disease Control and Prevention (CDC) and Johns Hopkins Arthritis Center, there were around 42.7 million adult patients of arthritis in the United States in 1995. [3] In 2015, this number increased to be around 54.4 million adult patients of arthritis in the United States. [1] By 2020, the expected number of adult patients of arthritis in the United States would raise to be 59.4 million. [3] Thus, the total of adult patients of arthritis in the United States increased by around 16.7 million in 25 years.

Although many physicians and scientists believe certain genetics and environmental factors may lead or worsen several types of arthritis, specific causes to cause or worsen a specific type of arthritis remain unknown. [1,2]

One of these environmental factors is smoking. [4] According to the World Health Organization (WHO) in 2017, smoking is accountable for the death of more than 7 million individuals per year. [5] In addition, WHO stated that if the manner of smoking in the world continues the same, by 2030 more than 8 million people would die per year. [6]

Smoking can cause many diseases including; heart diseases and lung cancer. Moreover, it has the ability to damage many organs of the human body. [7,8] While some researchers stated that smoking is a fundamental risk factor for certain types of arthritis, there are many researchers found that smoking can worsen arthritis conditions in many ways. [9,10]

Since that arthritis is an inflammation infects any joint of the body or tissues around that joint. According to Hosseinzadeh and his team in 2016, smoking has the ability to increase inflammation in the body by activating neutrophils (white blood cells) leading to increased inflammation and then worsen the condition of arthritis [11].

Health-related quality of life (HRQoL), in general, means measuring the effect of a specific disease, condition, or any other factors on the functions and health of the human body. The goal of measuring HRQoL is to assess patient's health and life from the patient's perspective.[3] Although there are many researches showed how smoking can worse the condition of arthritis as a disease, [3,9,10,12] there is not a specific study yet investigated the effect of smoking on HRQoL in adult patients of arthritis including activity limitations, physical health problems, and mental health problems, which is the purpose of this study.

Materials and Methods

Data source: This study used publicly open data source from the 2017 Behavioral Risk Factor Surveillance System (BRFSS) from Centers for Disease Control and Prevention (CDC) in order to investigate the effect of smoking on health-related quality of life (HRQoL) in adult patients of arthritis for both genders.

BRFSS data is the first national approach of health surveys in using the telephone in order to collect data from the United States residents in relation to their health and behaviors. Population of this data used for this study include adult patients of arthritis (18 – 65 years old), both genders as well as different races form all the states of the United states. [13] BRFSS is a source data that collects data about different types of diseases as well as behavioral, and social factors that can affect the quality of life in different patients.

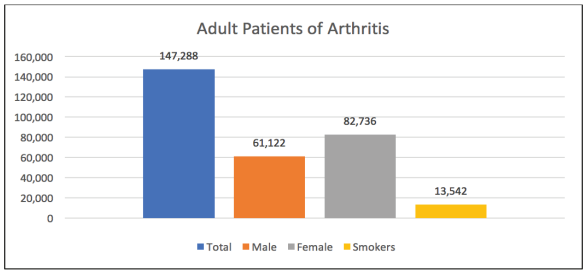
Variables: This study based on two questions as predictor variables and three questions as indicator variables. Predictor variable questions include; 1) having arthritis (HAVARTH3), and 2) currently a smoker (SMOKDAY2). In contrast, HRQoL indicator variables questions include; 1) self-assessment of having activity limitations (LMTJOIN3), 2) self-assessment of having physical health problems (PHYSHLTH) and, 3) self-assessment of having mental health problems (MENTHLTH).

Statistical Analysis: Various descriptive, inferential, and predictive analysis methods were used by the Statistical Analysis System (SAS-9.4 version) to achieve the goal of this study. After cleaning the data, different methods of frequency distributions were used to describe the variables of the study. Then, by choosing the significance level to be ($P \leq 0.05$), conducting inferential analysis, by using Chi-Square test, to check the association between these variables is the most important step. Finally, by using a method of predictive analysis, logistic regressions, relation among the variables of this study can be confirmed and the differences percentage can be calculated.

Results

There were 450,013 participants in 2017-Behavioral Risk Factor Surveillance System (BRFSS), 147,288 of these participants were adult patients of arthritis (18 years and older). 61,122 these patients are males and 82,736 are females. 63,466 of these participants in BRFSS-2017 were current smokers. 13,542 of these smokers were adults patients of arthritis (figure 1).

Figure 1: Distribution of adult patients of arthritis



Moreover, there were 69,913 non-smokers adult patients of arthritis with activity limitation while smokers' adult patients of arthritis with activity limitation were 11,461 (table 1). Also, there were 120,235 non-smokers adult patients of arthritis with physical health problems while smokers' adult patients of arthritis with physical health problems were 12,931 (table 1). However, for mental health problems, there were 32,660 non-smokers adult patients of arthritis with mental health problems while smokers' adult patients of arthritis with mental health problems were 8,231 (table 1).

Table 1: Distribution of adult patients of arthritis by activity limitations, physical health problems, and mental health problems

Distribution of adult patients of arthritis			
Variables		Non-smokers with arthritis	Smokers with arthritis
Activity limitations	Male	31,371	6,612
	Female	38,542	4,849
	Total	69,913	11,461
Physical health problems	Male	57,361	7,538
	Female	62,874	5393
	Total	120,235	12,931
Mental health problems	Male	11,724	4,821
	Female	20,936	3,410
	Total	32,660	8,231

Chi-Square test was used in this study to examine the association between predictor variables including arthritis and smoking and indicator variables of HRQoL (table 2).

Table 2: P-value of Chi-Square test to examine the association between predictor variables indicator variables

P-values of Chi-Square test			
Indicator variables of HRQoL		Predictor variables	
		Arthritis	Arthritis and Smoking
Activity limitations	Male	< .0001	< .0001
	Female	< .0001	< .0001
Physical health problems	Male	< .0001	< .0001
	Female	< .0001	< .0001
Mental health problems	Male	< .0001	< .0001
	Female	< .0001	< .0001

Logistic regression was used in this study to confirm the relation between predictor variables including arthritis and smoking and indicator variables of HRQoL (table 3)

Table 3: P-value and odds ratio of logistic regression to confirm the relation between predictor variables and indicator variables and to calculate the differences percentage.

P-values and odds ratio of logistic regression				
Indicator variables of HRQoL	Predictor variable			
	Arthritis Alone (Male and Female)		Arthritis and Smoking (Male and Female)	
	Pr > chi-Sq	OR	Pr > chi-Sq	OR
Activity limitations	0001. >	0.350	0001. >	0.924
Physical health problems	0001. >	0.823	0001. >	1.109
Mental health problems	0001. >	0.996	0001. >	1.201

Also, by using logistic regression, odds ratio (OR) can be taken to calculate the differences percentage of the effect of arthritis alone and arthritis with smoking on health-related quality of life (HRQoL) including activity limitations, physical health problems, and mental health problems. Differences percentage of the effect can be calculated by the following equation. [13]

$$\text{Percentage differences} = (VI-V2) / ((V1+V2)/2)*100$$

While:

V1= Number of exposed cases.

V2 = Number of exposed non-cases.

Discussion

Measuring health-related quality of life (HRQoL) for a specific population of a specific disease, factor, or even association among these several conditions and factors can give significant, reliable, sensitive, and interpretable results as well as an overview of these population life. Since there are many researches showed how smoking can worse the condition of arthritis as a disease and none one of them have investigated the effect of smoking on HRQoL in adult patients of arthritis, the overall goal of this study is to investigate that effect_based on measuring activity limitations, physical health problems, and mental health problems as HRQoL for adult patients of arthritis.

In the survey of 2017-Behavioral Risk Factor Surveillance System (BRFSS), there were 450,013 participants. This survey was used in this study as a source of data to accomplish the goal of this study. In order to confirm the effect of smoking on health-related quality of life (HRQoL) on adult patients of arthritis, this study performed different descriptive, inferential, and predictive analysis methods by the Statistical Analysis System (SAS-9.4 version).

In the descriptive analysis, there were450,013 participants and 147,288 of these participants were adult patients of arthritis (18 years and older). 61,122 of patients of arthritis are males and 82,736 are females. 63,466 of these participants in BRFSS-2017 were current smokers. 13,542 of these smokers were adults patients of arthritis (figure 1). These 13,542 smokers with arthritis are the main sample of this study to examine the differences between them and non-smokers with arthritis. Moreover, there were 11,461 smokers' adult patients of arthritis with activity limitation, 12,931 smokers' adult patients of arthritis with physical health problems, and 8,231 smokers' adult patients of arthritis with mental health problems (table 1).

To examine the associations between arthritis and smoking on health-related quality of life (HRQOL) including activity limitations, physical health problems, and mental health problems in adult patients of arthritis, inferential analysis by using Chi-Square test with a significance level of $P \leq 0.05$ were conducted. Results of inferential analysis showed all of p-values are < 0.0001 (table 2) concluding

that there are significant associations between arthritis and smoking with activity limitations, physical health problems, and mental health problems.

To confirm the hypothesis of this study, the relationship between variables of the study must be examined by predictive analysis. Logistic regression was used as a predictive analysis method to confirm the relation and extracting the odds ratio (OR) in order to calculate the differences percentage of the effect of arthritis alone on HRQoL as well as the effect of the association between arthritis and smoking on HRQoL of adult patients of arthritis.

Results of predictive analysis showed all of Pr > chi-Sq. is < 0.0001 (table 3) concluding that there are significant relations between arthritis and smoking with activity limitations, physical health problems, and mental health problems.

However, to measure the differences percentage between the effect of arthritis alone on HRQoL and the effect of the association between arthritis and smoking on HRQoL in adult patients of arthritis, odds ratio (OR) must be extracted (table 3). Differences percentage of the effect can be calculated by the following equation. [14]

$$\text{Percentage differences} = (VI-V2) / ((V1+V2)/2)*100$$

While:

V1= Number of exposed cases.

V2 = Number of exposed non-cases.

Odds ratio (OR) of the activity limitations for non-smokers adult patients of arthritis is 0.350 while in the activity limitations for smokers' adult patients of arthritis is 0.924 (table 3). Meaning that smokers' adult patients of arthritis have increased the activity limitations by 164% more than non-smokers adult patients of arthritis. Odds ratio (OR) of physical health problems for non-smokers adult patients of arthritis is 0.823 while in physical health problems for smokers' adult patients of arthritis is 1.109 (table 3). Meaning that smokers' adult patients of arthritis have increased physical health problems by 34.75% more than non-smokers adult patients of arthritis. Odds ratio (OR) of mental health problems for non-smokers adult patients of arthritis is 0.996 while in mental health problems for smokers' adult patients of arthritis is 1.201 (table 3). Meaning that smokers' adult patients of arthritis have increased mental health problems by 20.58% more than non-smokers adult patients of arthritis.

Conclusions

The overall goal of this study is to investigate the effect of the effect smoking on health-related quality of life (HRQOL) including activity limitations, physical health problems, and mental health problems in adult patients of arthritis. Data source of this study is 2017 Behavioral Risk Factor Surveillance System (BRFSS) from Centers for Disease Control and Prevention (CDC) in the United States. The results of this study based on 147,288 adult patients of arthritis (18 years and older).

13,542 of these patients were smokers. The results of this study used different descriptive, inferential, and predictive analysis methods by the Statistical Analysis System (SAS-9.4 version). This study showed that smoking can increase each of the activity limitations in adult patients of arthritis by 164%, physical health problems by 34.75%, mental health problems by 20.58%. Therefore, based on these finding, smoking has a great ability to worse health-related quality of life in adult patients of arthritis. However, even if this study showed the effect of smoking on HRQoL in adult patients of arthritis for both genders, as a limitation of this study, the reason behind that arthritis is more prevalent in female more than males remains unknown.

References:

[1] Centers for Disease Control and Prevention (CDC). Arthritis. 2019. Available at: https://www.cdc.gov/arthritis Retrieved from the internet on May 05, 2019.

[2] Arthritis Foundation. Arthritis by the Numbers / Book of Trusted Facts & Figures. 2018; v2; 4100.17.10445.

[3] F, Kevin. Arthritis and Health-related Quality of Life. 2019 Available at: https://www.hopkinsarthritis.org/patient-corner/disease-management/quality-of-life-and-arthritis/#ref1 Retrieved from the internet on May 05, 2019.

[4] Hutchinson D, Shepstone L, Moots R, et al Heavy cigarette smoking is strongly associated with rheumatoid arthritis (RA), particularly in patients without a family history of RA Annals of the Rheumatic Diseases 2001;60:223-227.

[5] World Health Organization (WHO). WHO Report on the Global Tobacco Epidemic. 2017. Geneva: Switzerland. World Health Organization.

[6] World Health Organization (WHO). WHO Report on the Global Tobacco Epidemic. 2011. Geneva: Switzerland. World Health Organization.

[7] Howard G, Wagenknecht LE, Burke GL, Diez-Roux A, Evans GW, McGovern P, et al. Cigarette smoking and progression of atherosclerosis: The Atherosclerosis Risk in Communities (ARIC) Study. JAMA. 1998 Jan 14;279(2):119-24.

[8] Doll R, Peto R, Wheatley K, Gray R, Sutherland I. Mortality in relation to smoking: 40 years' observations on male British doctors BMJ 1994; 309 :901

[9] Chang K, Yang S, Kim S, Han K, Park S, Shin J. Smoking and Rheumatoid Arthritis. International Journal of Molecular Sciences. 2014;15(12):22279-22295.

[10] Dunkin MA. 5 Reasons Smoking Makes Arthritis Worse. Arthritis Foundation. 2019. Available at: http://blog.arthritis.org/living-with-arthritis/smoking-risks-ra-oa/ Retrieved from the internet on May 10, 2019.

[11] A. Hosseinzadeh, P. R. Thompson, B. H. Segal, C. F. Urban. Nicotine induces neutrophil extracellular traps. Journal of Leukocyte Biology, 2016; 100 (5): 1105

[12] Dominick K, Ahern F, Gold C, Heller D. Health and Quality of Life Outcomes. 2004;2(1):5.

[13] The Behavioral Risk Factor Surveillance System (BRFSS). 2017 BRFSS Survey Data and Documentation. 2018. Available at: https://www.cdc.gov/brfss/annual_data/annual_2017.html Retrieved from internet on April 1, 2019.

[14] Clemson University.2006.Physics Tutorial: % Error & % Difference. Available at http://www.clemson.edu/ces/phoenix/tutorials/error/ Retrieved from internet on May 16, 2019.