

THE EPIDEMIOLOGICAL STUDY OF RHEUMATOID ARTHRITIS IN NIGERIA ENCOMPASSING SMOKING AS A RISK FACTOR USING CHI-SQUARE STATISTICS

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ABSTRACT

The research work is based on the epidemiology of rheumatoid arthritis in Nigeria considering smoking as a regional demographic risk factor. The prevalence of this disease is investigated. Data of Rheumatoid Arthritis patients; those infected by smoking and those infected by other risk factors were collected from randomly selected hospitals in Nigeria from 2010 to 2015 and analysed. The total sample size is 392 Rheumatoid Arthritis patients, that is 210 and 182 infected non-smokers and infected smokers respectively. The result revealed that the smokers stand higher risk of been infected than the non-smokers which means that the prevalence will be higher in various localities in years to come if smoking is not stopped.

1.0 INTRODUCTION

Arthritis is a Greek word that is derived from two words; "arthro" which means joint and "athris" which means inflammation. So arthritis simply refers to the inflammation of the joint. Almost any joint in the body can be affected. There are different types of arthritis depending on the pathology or the symptomatology. Hence, Rheumatoid Arthritis (RA) is a common chronic inflammatory autoimmune disease that damages the body's connective tissues, especially the synovial joints. Rheumatoid Arthritis affects women three times more than men. It is a systemic disease that may affect many different organs, including the skin, eyes, lung, heart and kidneys, but it is mainly characterized by the chronic inflammation of the joints resulting in painful and deformed joints due to bone erosion, destruction of cartilage and complete loss of joint integrity but the reaction is greater in the synovial joints.

It is not known what triggers the onset of rheumatoid arthritis. Regardless of the exact trigger, the result is an immune system that is geared up to promote inflammation in the joints and occasionally other tissues of the body. Immune cells, called lymphocytes, are activated and chemical messengers are expressed in the inflamed areas. Many cases are believed to result from an interaction between genetic factors and environmental exposures. Among the risk factors, the strongest and most consistent evidence according to Silman and Hochberg (2001), is for an association between smoking and RA. History of smoking is associated with a modest to moderate 1.3 to 2.4 times increased risk of RA onset.

The aim of this research work is to investigate smoking as a potential risk factor for Rheumatoid Arthritis since smoking is not only harmful to the smokers alone, but also to those inhaling it and in fact they take-in 70% part of it. Therefore, using demographic

data of patients (secondary data) obtained at random from different hospitals of Nigeria (North, East, and West). For instance, if smoking (cigarette, marijuana etc.) leads to high prevalence of Rheumatoid Arthritis, then Nigeria would be expected to display higher prevalence of Rheumatoid Arthritis.

Smoking and other dietary factors, microbial exposures like dust such as silica, wood, or asbestos is the main environmental risk factor. In industrialized countries, RA affects 0.5 - 1.9% of adults, John and Collins (2014).

The data used in this work were obtained from available health centres. Also, this work is not independent of other researchers since the researchers are not medical personnel. Records kept and available in the centres were used. Some hospitals don't have proper record and as such realistic estimates were made by the doctors.

2.0 HYPOTHESIS

H_0 : the tendency of population of infected non-smokers(χ_1) is less than the tendency of population of infected smokers(χ_2) and hence prevalence is higher.

H_1 : the tendency of population of infected non-smokers(χ_1) is greater than the tendency of population of infected smokers(χ_2) and hence prevalence is lower.

Mathematically represented as:

$$\left. \begin{aligned} H_0 &= \chi_1 < \chi_2 \\ H_1 &= \chi_1 > \chi_2 \end{aligned} \right\} \quad (1)$$

3.0 METHODOLOGY AND DATA PRESENTATION

Chi-Square Statistics is used to test for the prevalence of Rheumatoid Arthritis in the demographic region of Nigeria and the data used mainly in this research were secondary data. The Chi-Square Statistics as in Larose (2011), Sullivan (2013) and Johnson and Bhattacharyya (2001) further applied.

From the year 2010 to 2015, information of patients with the disease RA was taken at random from different hospitals in Nigeria. The general contingency table of the data collected were presented, where:

- r = individual row total, $i=0,1$
- c = individual column total, $i=0,1,2,3,4,5$
- n = total non-smokers (χ_1)
- n = total smokers (χ_2)
- c_1 = total patients in 2010
- c_2 = total patients in 2011
- c_3 = total patients in 2012
- c_4 = total patients in 2013
- c_5 = total patients in 2014
- c_6 = total patients in 2015

The population data are for the patients that visited the hospitals in the various communities where these hospitals are located.

3.1 Data from the Visited Hospitals.

Table 1: Rheumatoid Arthritis Patients from Umaru Sanda Ndayako General Hospital, Bida (hospital A).

YEAR	2010	2011	2012	2013	2014	2015	r_i
χ_1	-	2	-	-	4	1	7
χ_2	2	1	-	-	-	-	3
c_i	2	3	0	0	4	1	10

Source: Umaru Sanda Ndayako General Hospital, Bida.

From the table above;

Total infected non-smokers = 7

Total infected smokers = 3

Total patients from the year 2010 to 2015 = 10

Table 2: Rheumatoid Arthritis Patients from Federal Medical Centre Abeokuta (hospital B).

YEAR	2010	2011	2012	2013	2014	2015	r_i
χ_1	15	5	16	10	14	28	88
χ_2	10	2	8	12	10	20	62
c_i	25	7	24	22	24	48	150

Source: Federal Medical Centre, Abeokuta.

From the table;

Total infected non-smokers = 88

Total infected smokers = 62

Total patients from the year 2010 to 2015 = 150

Table 3: Rheumatoid Arthritis Patients from Shekinah Medical Centre, Oyo (hospital C)

YEAR	2010	2011	2012	2013	2014	2015	r_i
X_1	-	3	4	-	2	-	9
X_2	-	2	2	2	1	2	9
c_i	0	5	6	2	3	2	18

Source: Shekinah Medical Centre, Oyo

From the table above:

Total infected non-smokers = 9

Total infected smokers = 9

Total patients from the year 2010 to 2015 = 18

Table 4: Rheumatoid Arthritis Patients from Lautech Teaching Hospital, Ogbomoso (hospital D).

YEAR	2010	2011	2012	2013	2014	2015	r_i
X_1	10	2	-	5	15	20	52
X_2	7	1	5	8	7	14	42
c_i	17	3	5	13	22	34	94

Source: Lautech Teaching Hospital, Ogbomoso.

From the table above:

Total infected non-smokers = 52

Total infected smokers = 42

Total patients from the year 2010 to 2015 = 94

Table 5: Rheumatoid Arthritis Patients from Federal Medical Centre, Abia (hospital E).

YEAR	2010	2011	2012	2013	2014	2015	r_i
X_1	7	22	10	-	9	6	54
X_2	12	6	16	9	11	12	66
c_i	19	28	26	9	20	18	120

Source: Federal Medical Centre, Abia

From the table above:

Total infected non-smokers = 54

Total infected smokers = 66

Total patients from the year 2010 to 2015 = 120

4.0 RESULTS AND ANALYSIS

If the calculated value is less than the table value, the null hypothesis (H_0) is accepted and the alternative hypothesis (H_1) is rejected. If otherwise, accept the Alternative Hypothesis (H_1). Using;

$$X^2 = \sum_i \frac{(O_i - E_i)^2}{E_i} \quad (2)$$

Where,

$O_i = f_o =$ Observed frequency of the infected non-smokers and infected smokers.

$E_i = f_{e_i} =$ Expected frequency of the infected non-smokers and infected smokers.

Hence;

$$X^2 = \sum_i \frac{(f_o - f_{e_i})^2}{f_{e_i}} \quad (3)$$

Where;

$$f_o = a, b, c, d, e \text{ and } f \quad (4)$$

$$f_{e_i} = \frac{\text{Row Total} \times \text{Column Total}}{\text{Grand Total}} \quad (5)$$

The result from the data is further analyzed.

Table 6: Total Observed Data Contingency table.

YEAR	2010	2011	2012	2013	2014	2015	r_i
χ_1	32	34	30	15	44	55	210
χ_2	31	12	31	31	29	48	182
c_i	63	46	61	46	73	103	392

From random selection of hospitals in Nigeria and collection of available data from doctors and relevant sources in various health institutions, the total patients are summed up to be 392, neglecting the population of the infected people that fail to go for treatment in those communities where the hospitals are located.

From table 6, total infected non-smokers = 210

Total infected smokers = 182

Total patients from the year 2010 to 2015 = 392

Table 7: Summary of the Collected Data.

PREVALENCE OF RHEUMATOID ARTHRITIS			
Source	X_1	X_2	Row totals
A	7	3	10
B	88	62	150
C	9	9	18
D	52	42	94
E	54	66	12
Column Totals	210	182	392

Table 7 gives the general contingency table by comparing tables 1,2,3,4 and 5. Hence, the individual expected count is calculated using equation (3).

Table 8: Calculated Value.

PREVALENCE OF RHEUMATOID ARTHRITIS					
Row-column	f_0	f_{e_i}	$(f_0 - f_{e_i})$	$(f_0 - f_{e_i})^2$	$\frac{(f_0 - f_{e_i})^2}{f_{e_i}}$
1-1	7	5.4	1.6	2.56	0.4741
1-2	3	4.6	-1.6	2.56	0.5565
2-1	88	80.4	7.6	57.76	0.7184
2-2	62	69.6	-7.6	57.76	0.8299
3-1	9	9.6	-0.6	0.36	0.0375
3-2	9	8.4	0.6	0.36	0.0429
4-1	52	50.4	1.6	2.56	0.0508
4-2	42	43.6	-1.6	2.56	0.0587
5-1	54	64.3	-10.3	106.09	1.6499
5-2	66	55.7	10.3	106.09	1.9047
Total	392	392	0.0	338.	6.3234

From table 8, the individual expected counts (f_{e_i}) has been derived and hence the calculated value (chi-square (X^2)) is therefore:

$$X^2 = \sum_{i=1}^n \frac{(f_0 - f_{e_i})^2}{f_{e_i}} = 6.3234 \quad (6)$$

The Confidence Interval (α) is taken as 0.05 on the X^2 table values. Therefore, the table value is determined using the degree of freedom (df) 4. Hence, the table value is 9.488 which is greater than the calculated value. Consequently, the null hypothesis is accepted.

5.0 Conclusion

The result revealed that $H_0: x_1 < x_2$, which is consistent with the computer output (see appendix), indicating that smokers are at higher risk of been infected with Rheumatoid Arthritis than the non-smokers. This shows that the prevalence of Rheumatoid Arthritis in Nigeria, both in the young and adult, in the future will be very high if smoking (tobacco, marijuana, helms etc.) is not reduced or stopped in our various localities. The research work agrees with the finding of Silman and Hochberg (2001).

Consequently, it is recommended that the Federal Government of Nigeria should stop smoking of cigarettes in at least public places as it is harmful to the health of humans. More hospitals with rheumatology departments and rheumatologists should be sited both in rural and urban areas of the country. Furthermore, those that notice obstructions in their joints should go for medical check-up on time and stop self-medication. Finally, smokers should know that, they are liable to die young.

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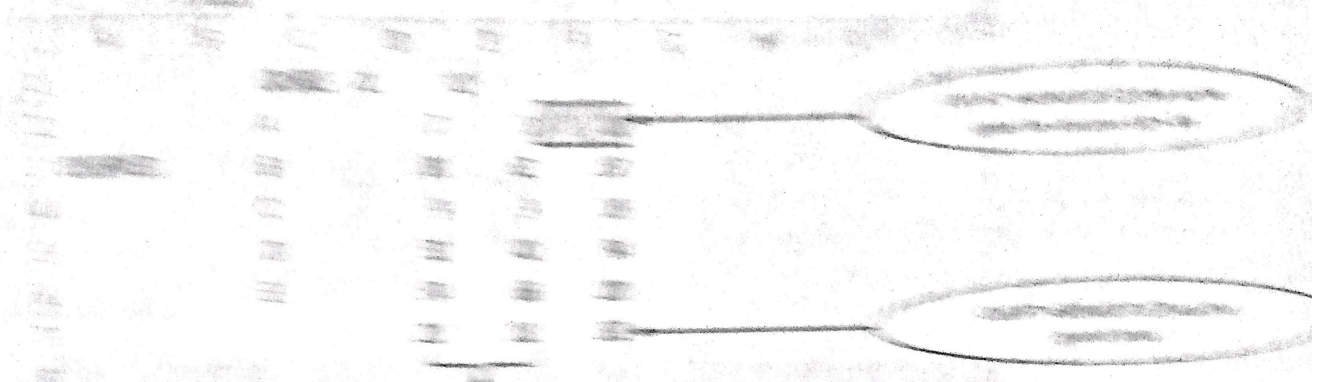
We are indeed, indebted to them all.

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Screen 3:

Observed minus expected counts.

	A	B	C	D	E	F	G	H
1			SOURCE	X1	X2			
2		A		1.64	-1.6			
3	OBSERVED MINUS	B		7.64	-7.6			
4	EXPECTED	C		-0.64	0.64			
5		D		1.64	-1.6			
6		E		-10.3	10.3			
7								
8								
9								(O-E) Squared/E
10								

Screen 4:

Observed minus expected counts squared.

	A	B	C	D	E	F	G	H
1	(O-E) square		SOURCE	X1	X2			
2		A		2.699	2.7			
3		B		58.41	58.4			
4		C		0.413	0.41			
5		D		2.699	2.7			
6		E		105.8	106			
7								
8								
9								
10								

