Publications of HIV Vaccine Research Output in PUBMED Database: A Study

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Abstract

HIV Vaccine is a subject that is most studied all over the world and research is going on. As such, no steps have been taken so far to picture the trend in the subject growth. The trend of Authorship pattern and also discussed year-wise authorship. Thus, this paper attempts to study the trend in the growth by applying the least square method and Price's fundamental law.

KEYWORDS: HIV Vaccine, Price's fundamental law of science, PUBMED Database, Trend analysis – research productivity on HIV Vaccine.

INTRODUCTION

Scientometric applications are growing at present to cope up with the ever-growing nature of subjects. Bioelectronics is a subject of new origin. The literature available on the subject in PUBMED reveals that the literature growth of the subject starts in the early nineties. In this context, this paper intended to apply a few of the scientometric applications along with picturizing the trend of the growth of the subject.

On the HIV Vaccine, no steps have been taken so far to picturise the trend in the subject growth. Thus, this paper attempts to study the trend in the growth of research productivity of the subject over 20 years.

OBJECTIVES OF THE STUDY:

The objectives of the study are as follows:
- To identify the year-wise distribution of the literature on HIV vaccines.
- An Application of time-series analysis to picturise the trend on the growth of the literature output.
- Applications of Price's Fundamental Law of Science for the identification of trends in HIV Vaccine research output.

RESEARCH METHODOLOGY:

For this research, a total no. of 10268 records on HIV Vaccine Research are downloaded from the PUBMED database over 20 years starting from 2001 – 2020. The bibliographical elements that are suitable for trend analysis and applications of Price's fundamental law are taken into account for the analysis. Thus, the analysis and the results are presented as follows:

Table 1 Year Wise Growth of HIV Vaccine ResearchPublication

Sr. No.	Year	Articles	Percentage
1	2001	390	3.80
2	2002	409	3.98
3	2003	448	4.36

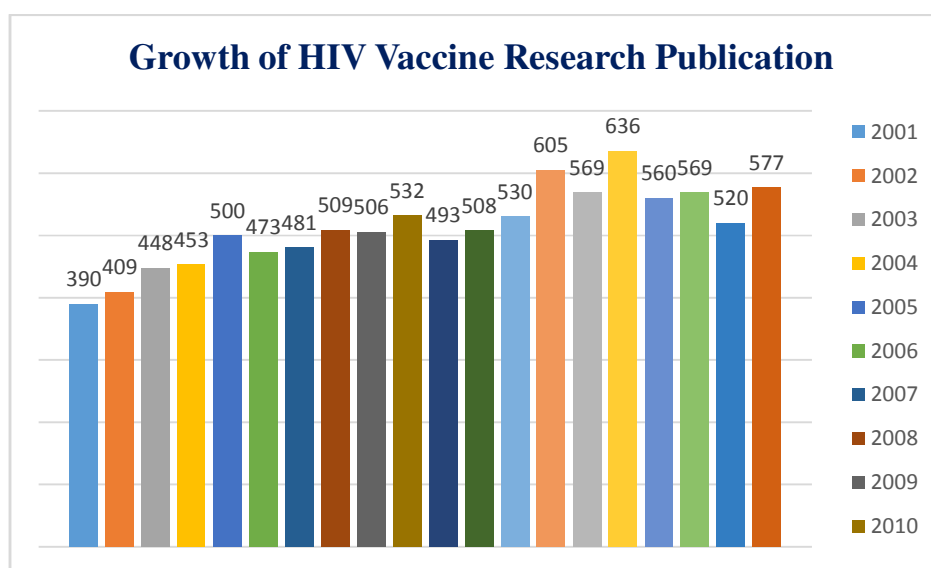| 4 | 2004 | 453 | 4.41 |
5	2005	500	4.87
6	2006	473	4.61
7	2007	481	4.68
8	2008	509	4.96
9	2009	506	4.93
10	2010	532	5.18
11	2011	493	4.80
12	2012	508	4.95
13	2013	530	5.16
14	2014	605	5.89
15	2015	569	5.54
16	2016	636	6.19
17	2017	560	5.45
18	2018	569	5.54
19	2019	520	5.06
20	2020	577	5.62

Figure No. 1: Growth of HIV Vaccine Research Publication

Table 1 shows the growth of HIV Vaccine research for a period of 20 years from 2001 to 2020. It is seen from the table that the research productivity is under study. It is found that throughout the study period, there is gradual growth.

Table 2 HIV Research trend – Time Series Analysis

Sr. No.	Year	Papers (Y)	X	X2	XY
1	2001	390	-9	81	-3510

2	2002	409	-8	64	-3272
3	2003	448	-7	49	-3136
4	2004	453	-6	36	-2718
5	2005	500	-5	25	-2500
6	2006	473	-4	16	-1892
7	2007	481	-3	9	-1443
8	2008	509	-2	4	-1018
9	2009	506	-1	1	-506
10	2010	532	0	0	0
11	2011	493	1	1	493
12	2012	508	2	4	1016
13	2013	530	3	9	1590
14	2014	605	4	16	2420
15	2015	569	5	25	2845
16	2016	636	6	36	3816
17	2017	560	7	49	3920
18	2018	569	8	64	4552
19	2019	520	9	81	4680
20	2020	577	10	100	5770
Total		10268		670	11107

One of the best ways of obtaining trend values is the method of least square. It is a statistical procedure from which a straight line trend is obtained. This line is called the line of best fit. It is a line from which the sum of the deviations of various points on either side is equal to zero i.e $\sum(y-y_c)=0$ and the sum of the squares of these deviations of actual and computed value would be least as compared to other lines i.e $\sum(y-y_c)^2$ is least. For this reason that the sum of the squares of variations of various points from the line of the best fit is the least. This method is known as a method of least square. The method is used to fit a straight line trend or a parabolic trend.

To arrive at assessments for future growth, Staight line equation is applied Under the Time series analysis.

Straight line equation is Y=a+bx, since $\Sigma x=0$

a=Σxy/N=11107/20   b=$\Sigma XY/\Sigma X^2$

a=11107/20   b=11107/670=16.57

Estimated literature in 2030 is, when X=2030-2009=21

Y=a+bX

Y=555.35+16.57*21=903.32

From the above result, it is found that there is an increasing trend of research literature in the future year. Therefore the corollary of study is HIV Vaccine research literature is growing.

Table 3 Authorship Pattern year wise

| Year	articles	Single Author	Two Author	Three Author	Four Author	More Than Four Author	Total	Percentage
2001	390	141	73	50	45	248	557	2.92
2002	409	129	70	63	45	263	570	2.99
2003	448	156	97	65	36	288	642	3.36
2004	453	122	86	57	55	329	649	3.40
2005	500	131	74	68	75	413	761	3.99
2006	473	110	96	85	57	475	823	4.31
2007	481	117	101	83	75	447	823	4.31
2008	509	138	107	67	67	480	859	4.50
2009	506	113	107	90	75	509	894	4.69
2010	532	109	133	85	71	578	976	5.12
2011	493	113	97	86	87	628	1011	5.30
2012	508	84	125	94	87	611	1001	5.25
2013	530	81	115	107	77	688	1068	5.60
2014	605	71	125	110	94	818	1218	6.38
2015	569	70	112	107	95	864	1248	6.54
2016	636	66	103	112	93	910	1284	6.73
2017	560	61	104	96	93	787	1141	5.98
2018	569	37	72	96	90	827	1122	5.88
2019	520	41	73	88	90	860	1152	6.04
2020	577	40	84	102	113	942	1281	6.71
Total		1930	1954	1711	1520	11965	19080	100
Percentage		10.12	10.24	8.97	7.97	62.71	100	
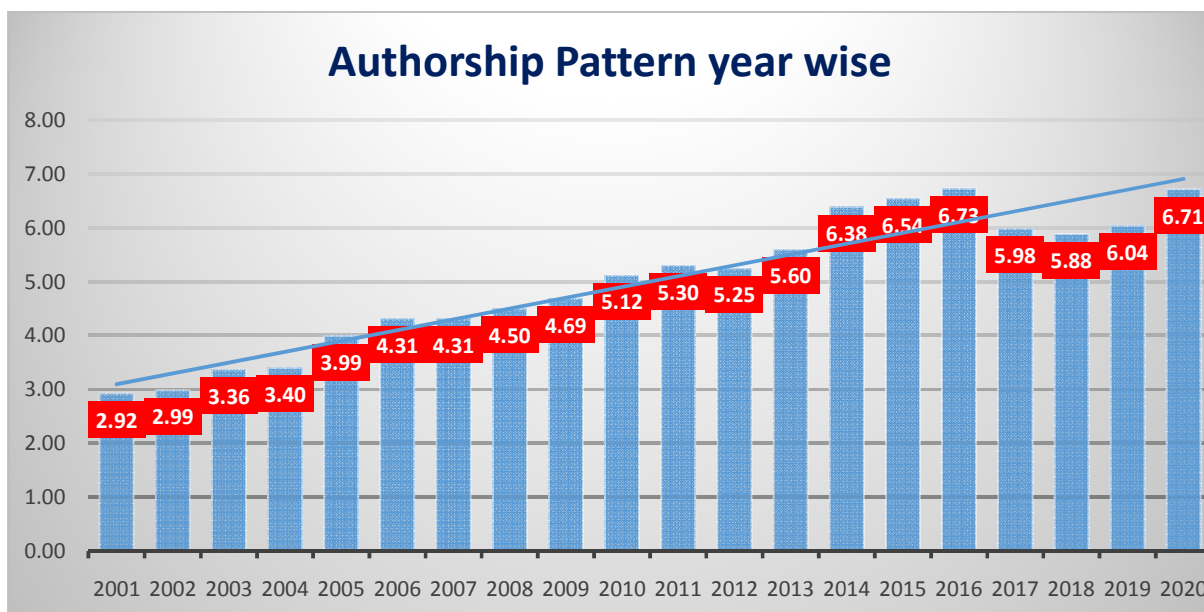
Figure No. 2: Authorship Pattern year wise

Table no. 3 shows that the 141 articles written by a single author and it is the highest number published in PubMed2001. It indicates also that 40 articles were written by a single author published in PubMed 2020. It is the lowest number. The number of research articles has been published in PubMed written by two authors i.e. 133 (2010) it is the highest number and 70 articles published in 2002 with the lowest number. It indicates that in 2016, 112 research articles are published written by three authors as well as 50 research articles are published in 2001 and those are the lowest number.

113 articles written by four authors published in 2020 i.e. highest number. More than four authors contributed 942 highest research articles in the year 2020. 248 It is the lowest contribution in the year 2001.

Table 4 Trend in Authorship Pattern

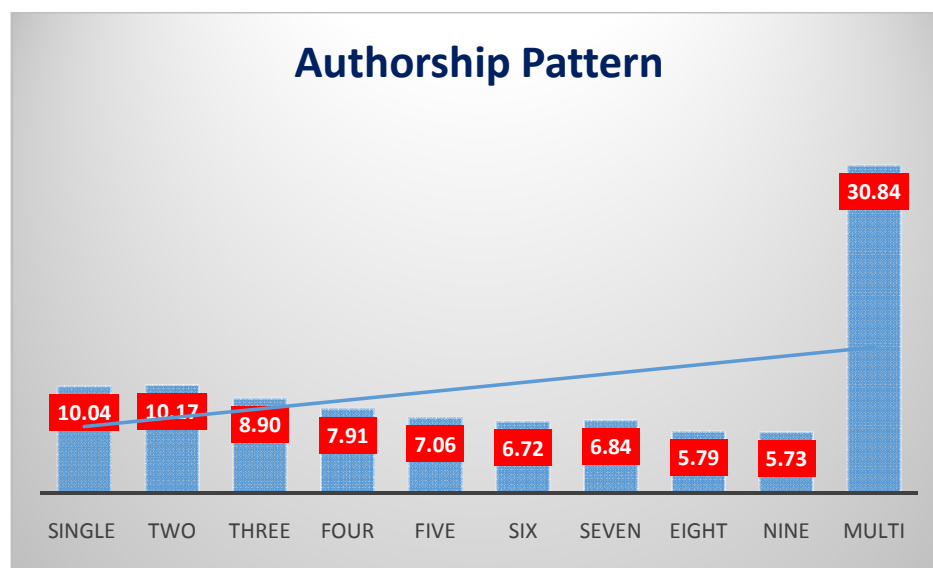| Sr. No.	Authorship	Number of Citation	%
1	Single	1930	10.04
2	Two	1954	10.17
3	Three	1711	8.90
4	Four	1520	7.91
5	Five	1357	7.06
6	Six	1292	6.72
7	Seven	1314	6.84
8	Eight	1113	5.79
9	Nine	1102	5.73
10	Multi	5929	30.84
	Total	19222	100

Figure No. 3: Authorship Pattern year wise

The characteristics of any subject literature include not only the basic publishing pattern but that of authors themselves so the authors were analyzed to determine the percentage of single, two, three, and more than three authors. To have a clear picture the results of the analysis of authors are presented. Table No.4 and Figure No.4 indicates that out of the total number of 19222 citations 1930 (10.04%) are by a single author, followed by 1954 (10.17%) citations by joint authors, 1711 (8.90%) citations have three authors, 1520 (7.91%) Citation by four authors, 1357 (7.06%) citations have five authors, 1292 (6.72%) citations have six authors, 1314 (6.84%) citations have Seven authors, 1113 (5.79%) citations have eight authors, The finding also shows that the least citations are by nine authors i.e. 1102 (5.73%). And the Multi-author citations are 5929(30.84%) citations respectively.

Table 5Price's Fundamental Law of Science for the trend in bioelectronics research output

Sr.No.	Year	Time	Number of Authors	Exponential Growth$b=y_t/y_{t_o}$
1	2001	0	2842	
2	2002	1	3097	1.09
3	2003	2	3292	1.06
4	2004	3	3847	1.17
5	2005	4	4730	1.23
6	2006	5	5281	1.12
7	2007	6	4969	0.94
8	2008	7	5433	1.09

9	2009	8	5845	1.08
10	2010	9	6606	1.13
11	2011	10	7486	1.13
12	2012	11	7538	1.01
13	2013	12	8301	1.10
14	2014	13	10061	1.21
15	2015	14	11186	1.11
16	2016	15	11769	1.05
17	2017	16	10451	0.89
18	2018	17	10676	1.02
19	2019	18	11536	1.08
20	2020	19	13416	1.16
			148362	

Price's[1] celebrated lectures on "Little Science and Big Science" reviewed some earlier works by Francis Galton, J.M.Cattell and A.J.Lotka and presented a notable "feeling that most of the great scientists are still with us and that the greater part of scientific work has been produced within living memory, within the span of the present generation of scientists". He considers an exponential time trend as the appropriate model to fit for data on the number of scientists. He calls this principle of exponential growth as the "fundamental law of any analysis of science".

Let y_t = number of scientists during a period t. (t maybe just 1 year or a span of say, 20 years).

$y_t = e^{a'+b' t}$

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1 log y_t = a'+b't Let a' = log a and b' = log b.

Then log y_t = log a+ t log b

Or y_t = a.* b^t

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In (2) if b>1 the exponential curve is rising over time (+ve growth) and if b<1, a curve is falling (-ve growth). (2) may also be written as

$y_t = y_0 * b^t$ (Since t=0, y_0=a=number of scientists in the beginning). or

$y_t = y_{t-1} * b$

Since b>1, the number of scientists during any period t is greater than those existing during any particular period in the past.

From table 5 it is seen that the exponential growth rate is greater than 1 in all the years and hence proving Price's Fundamental law of science.

CONCLUSION

As this bibliometric analysis draws on publicly available data and does not directly involve human participants, ethical review is not required. Results of this analysis will identify the trends in HIV vaccine research publications. In author collaboration, multi-authors dominated on other authorship collaboration patterns. This

study will also highlight strengths, weaknesses, and opportunities in areas such as the quality and type of research being conducted and could be used to guide the allocation of HIV vaccine research. Authorship pattern research is recognized as important in providing innovative solutions to complex problems such as the HIV vaccine.

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