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Research Article

Bibliometrics of the Global Drug Abuse Research Output as Reflected by Coverage in Web of Science Core Collection during 2011-2018

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ABSTRACT

Drug abuse is a serious public health problem that causes several social problems. The paper presents a bibliometric analysis of 16,745 papers published on drug abuse research during 2011-2018 and indexed by the Web of Science core collection. The study examines the pattern of drug research output during the study period; identifies most productive countries, institutions and authors and examines the impact of their output. Among the key findings are that the research output from 2014 shows a downward trend in spite of drug abuse increasing worldwide. Research activity as indication by publication output is found to be highly concentrated among the advanced economy (higher income) countries of the world with USA topping the list contributing more than half of the publication output. The value of Citation per Paper (CPP) which indicates to some extent how paper is valued by the research community showed that UK and the Netherlands had highest values of this indicator. University of California Systems (USA) followed by Harvard University (USA) topped the list of most productive institutions. The distribution of citations indicates that about one per cent papers received 100 or more citations.The pattern of communication of the scholars indicates that the total output was scattered among 2469 journals originating from 61 countries. More than three-fourth (76.5%) of these journals were published from three countries, namely USA (48.7%) followed by UK (23.1%) and the Netherlands (4.7%).The study indicates no correlation between death rate of a country due to drug abuse with its publications output. The study points out that research need to focus on countries that have high drug abuse which are increasingly observed in developing and marginalized economies. It calls for mechanisms to support research in developing and marginalised economies as drug abuse is so prevalent in these countries.

Keywords: Drug Abuse, Substance abuse, Bibliometrics, Global output, Web of Science.

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INTRODUCTION

Addiction to drugs is increasingly becoming a worldwide trend in lifestyle that is prevalent in rich and poor countries alike. Drug abuse has a significant impact on global health and socioeconomic condition in most countries of the world. It is pertinent to specifically define what we mean by "drug" here. Often the terms "drug" and "medicine" are used interchangeably by the common people but here we refer to psychoactive drugs also called pleasure drugs or recreational drugs which are banned and their consumption and possession is illegal in almost all the countries around the world. However, recently Canada has become the second country after Uruguay to legalize possession and use of recreational cannabis and the first major G7 country to do so. However, outside US federal jurisdiction 11 US states have done so.

"Drug abuse[1] refers to the use of legal or illegal substances in ways that one should not". Drugs have a negative connotation and are primarily used by the populace as a pleasure drug which are harmful and capable of altering the central nervous system, stupefy the mind, cause euphoria, change the perception and mood, give a high or kick, impair cognitive development and lead to addiction. These drugs in varying degree target the pleasure centre of the brain.

Abused drugs include Methamphetamine, Anabolic steroids, Club drugs, Cocaine, Heroin, Inhalants, Marijuana, Prescription drugs, including opioids.[2] Drug abuse is a serious public health problem that causes several social problems like drugged driving; violence, stress and child abuse. It costs nations in terms of lost work productivity and individuals with several health issues. According to a study by Shield, Rylett and Gmel[3] it is estimated that approximately 2000 million

individuals use alcohol worldwide. In a study by Degenhardt and Hall[4] it was observed that 200 million people used illicit drugs and illicit drug use directly accounts for 0.8% of global disability-adjusted life-years (DALYs), in which Opioids dependence has the largest contribution.[5] The focus of the present paper is to deal with those drugs which are consumed by the populace for the purpose for perceived pleasure using bibliometric techniques.

Bibliometrics is a technique that makes an objective assessment of publication output and its citation impact in a specific field of knowledge. It helps in determining the current state of research in a field and broadens our horizon for future research. The present study makes a bibliometric analysis of global output of research on drug abuse based on 16,745 records indexed in *Web of Science Core Collection* of Clarivate Analytics (formerly Thomson Reuters, USA) for the period 2011–2018 (8 years) to identify most productive countries, institutions and authors and examines the impact of their output using Citation per Paper (CPP) and Relative Citation Impact (RCI), described in succeeding paragraphs. The study also examines the pattern of citations and identifies journals used for communicating research results. The finding of this study might be useful for future research, for a more comprehensive understanding of the trends in the discipline of drug abuse.

Literature Review

Several studies have been reported in literature which has used bibliometrics to identify the research tends in the area of drug abuse. For instance, Bramness, Henriksen and Person[6] compared the publication and citation rate in the area of drug abuse and dependence research of Europe with USA for a period of ten years (2001–2010) using *Web of Science* of the Thomson Reuters (now Clarivate Analytics). Authors found that two third of the publications originated from USA. However, the citations were distributed evenly. Sweileh, Zyoud and Al-Jabi[7] assessed research productivity in the field of substance use disorders in Arab countries using *Web of Science* database for a period of more than 200 years (1900–2013). Authors found that research in this field was largely neglected in the past. However, research interest has increased recently. Saudi Arabia produced highest number of research papers. The value of CPP was 10.76 and maximum number of papers was published on tobacco and smoking and least on alcohol consumption and abuse. Khalili, Rahimi-Movaghar and Shadloo[8] conducted a scientometric study to quantify the number of publications and the growth rate of publications on illicit drug addiction at global, regional and country levels using *Scopus* database for the period of 1995–2014. Authors found that about 81% of total output came from 10 high income countries. Highest number of documents was published on Opioids. Zyoud, Waring and Al-Jabi[9] analyzed 2,902 papers related to cocaine published during 1975 to 2015 and indexed in *Web of Science*. Authors found that USA topped the list with 2,089 papers and most of the papers were published on reproductive toxicity, clinical management of acute cocaine exposure, laboratory methods for detection of exposure to cocaine, cocaine metabolism and cocaine toxicity in animals. Sánchez-Carbonell, Guardiola and Bellés[10] analyzed scientific publications on alcohol and drug misuse in EU member countries during 1976–2000 using *PsycINFO*. Authors concluded that Great Britain published about 38% of papers followed by Sweden, Germany and Spain accounting for a further 30% output. Maximum articles were published on drug and alcohol usage, substance abuse and drug and alcohol rehabilitation. The research results appeared in more than five hundred journals.

Bibliometric Indicators Used

A wide range of bibliometric indicators are available in the literature to assess the impact of the research output of countries, institutions and authors. Authors have used total number of publications (TNP) and total number of citations (TNC) as the absolute indicators of scientific output and impact. The value of TNP and TNC was directly obtained from the published data obtained from *Web of Science Core Collection*. Besides these two absolute indicators, authors also used two relative indicators, namely, citations per paper (CPP) and relative citation impact (RCI). CPP is defined as the average number of citations per paper. RCI is a measure of both the influence and visibility of a nation's research in the global perspective and May[11] used it first time to assess the scientific wealth of nations. It is defined as 'a country's share of world citations in the subspecialty/country's share of world publications in the subspecialty'. RCI = 1 denotes that a country's citation rate is equal to world citation rate; RCI < 1 indicates that a country's citation rate is less than the world citation rate and also implies that the research efforts are higher than its impact; and RCI > 1 indicates that a country's citation rate is higher than the world's citation rate and also implies high-impact research in that country. Here CPP and RCI have been used for a meaningful comparison of the impact of the research output for different countries, prolific institutions and authors. These two indicators have been widely used in bibliometrics studies[12,13] to normalize the large disparity in the volume of published output among disciplines, countries and institutions for a meaningful comparison of research impact.

Objectives

The study attempts to capture the research activity in drug abuse using bibliometric analysis of research papers published in this area during 2011–2018. To meet this objective, the study looks at the key trends based on publication productivity

and citation impact. The implications of this are seen in the larger context of research in this important area.

Methodology

The source of data for the present bibliometric study is *Web of Science core collection*, a product of Clarivate Analytics, USA. Articles published on drug abuse during 2011-2018 were downloaded from *Web of Science core collection* by using the keywords "Drugs addiction" OR "Substance abuse" OR "Drug abuse" OR "Drug problems" OR "Substance related disorder" OR "Street drugs". The search resulted in 18,431 records in all. The downloaded data contained the information about type of documents like reviews, research articles, proceeding papers published as journal articles, meeting abstracts, editorials, letters and notes etc, name of author(s) with their affiliation(s), year of publication, name of the publishing journal with its place of publication and citations obtained by each article, etc. The data was further enriched by impact factor of the publishing journals. The study is based on complete count of countries, institutions and authors. The method of complete count results in inflation of publication and citation data as the papers written in collaboration are counted as many times as the number of authors. The downloaded data was analysed using Fox-Pro software to meet the objectives described above.

RESULTS

Distribution of output by type of documents

During eight years period of 2011-2018, scholars from different parts of the globe published 18,431 documents on different aspects of drug abuse. Data indicates that highest number 14,969 (81.2%) of records were published as journal articles followed by reviews 1,640 (8.9%) and proceeding papers published as journal articles 136 (0.74%). These three types of documents constituted 16,745 (90.8%) records, which the authors have subjected to further detailed bibliometric analysis. Remaining 1,686 (9.2%) records were distributed as meeting abstracts 756, editorials 471, proceeding papers 217, book reviews 82, letters 73, news items 34, book chapters and corrections each 23, reprints 3, article retracted 2, article withdrawn 1 and software review 1. These have not been included in the analysis as these carry very little or no scientific information and are cited rarely in literature and hence do not add to the citation impact of research output of a country or institution or author.

Distribution of output by language

Analysis of 16,745 records included in the analysis indicates that these were published in 20 different languages. Highest numbers of papers 16,180 (96.6%) were published in English language. In other languages where more than 50 papers published were Spanish (170), German (137), French (88) and Portuguese (55) and constituted about 2.7% of the total output. Thus the number of papers published in these five languages constituted about 99.3% of total output. Remaining 0.7% papers were scattered in other 16 languages spoken in different parts of the globe. The number of papers in each language was Turkish (33), Polish (21), Russian (11), Japanese (10), Italian (9), Korean (7), Swedish (3), Afrikaans, Croatian and Serbian each 5, Czech (3), Swedish (2) and Dutch, Icelandic, Norwegian and Slovene each (1). Thus, like any other field of science and technology, maximum papers were published in English language with a miniscule output in other 19 languages. It indicates that global drug research is highly scattered in terms of language.

Chronological growth of output

Table 1 presents the chronological distribution of output during the eight years period of 2011-2018. Data presented in Table 1 depicts the absolute publication and proportion of output during the period studied. It indicates that the output hovered around 11% to 13% during the period of study. The pattern of output indicates that the highest number of papers was published in the year 2013 closely followed by the output in 2012 making about one-fourth (26.4%) of the total output. The output started declining after 2014 onwards and reached at the lowest level in the year 2018, but the decline in annual growth rate was steep in the year 2017.

Annual growth rate has been calculated using the formula given below:

{(Final value – Start value) / Start value}*100. For example Annual growth rate for 2012 will be {(2202 – 2075) / 2202) * 100} = {(127 / 2075) *100} = 6.1% and like that for other years. Overall decline, however, is not steep and is about 1% as compared to the initial year 2011.

Distribution of output by country and their citation impact

The total drug abuse research output originated from 109 countries scattered all over the globe. Table 2A lists 16 countries

Table 1: Pattern of publications output.

Year	Number of Papers	% of Papers	Growth Rate (%)
2011	2075	12.4	-
2012	2202	13.2	6.1
2013	2212	13.2	0.5
2014	2147	12.8	(-) 2.9
2015	2073	12.4	(-) 3.4
2016	2158	12.9	4.1
2017	1950	11.6	(-) 9.6
2018	1928	11.5	(-) 1.1
Total	16745	100.0	-

producing one per cent or more of the publications. The share of these countries is about 90.8% of the total global output. Remaining 9.2% output was scattered among 93 countries. This indicates that the drug research is highly scattered as only a minuscule portion of output was produced by a large number of countries. Among the most prolific countries, USA topped the list with more than half (55.5%) share of the publication output. The share of other 15 countries listed in Table 2A is slightly more than one-third (35.3%) again reflecting a highly scattered nature of output. Among these only three countries namely Canada, UK and Australia, produced more than 3% of the output and the share of output of the remaining 12 countries was less than 3%. These findings are similar to the cocaine intoxication research output by Zyoud, Waring and Al-Jabi.[9] In the present study also, USA produced far more papers than European countries in research related to drug abuse like the study by Bramness, Henriksen and Person.[6] Data depicted in Table 2A indicates that the value of CPP for the global output is 11.6. Among all the 16 countries listed in Table 2A, the value of CPP is higher than global value for 12 countries and less than global value for four countries namely China, Brazil, South Africa and Iran. The value of RCI for these four countries is considerably less than 1. This indicates that the research impact of these four countries is not commensurate to their research output. The value of CPP is highest for UK closely followed by the Netherlands. Like publication output, USA also had the highest share of citations. These findings are similar to the findings of the study by Bramness, Henriksen and Person.[6] However, the value of CPP for USA is considerably lower than that of UK and the Netherlands. The lowest value of CPP was for Iran. Also 93 countries whose names have not been listed had a poor citation impact of research output as reflected by low values of CPP and RCI. Data presented in Table 2A on the rank of the county in terms of death rates (DR) due to drug abuse per 100,000 of population has little bearing on the quantum of the research output produced by the country.

Death rate and publication productivity

Table 2B provide details of death rate (DR) and publication output of top 50 countries in terms of death rate. The data is available on the website www.worldlifeexpectancy.com. According to this, Ukraine tops the rank among all the 183 countries with a death rate of 10.96 per 100,000 population but it produced only 19 papers followed by USA which ranked second in terms of death rate but had the maximum 10472

Table 2A: Prolific countries and their citation impact.

#	Country	R/DR	TNP	TNP (%)	TNC	TNC (%)	CPP	RCI
1	USA	2/10.81	10472	55.49	152055	69.37	14.5	1.3
2	Canada	17/3.73	987	5.23	14253	6.50	14.4	1.2
3	UK	18/3.72	781	4.14	15167	6.92	19.4	1.7
4	Australia	11/4.55	763	4.04	11491	5.24	15.1	1.3
5	Germany	39/2.00	522	2.77	6577	3.00	12.6	1.1
6	Spain	75/1.30	476	2.52	6083	2.78	12.8	1.1
7	Italy	101/1.01	467	2.47	6385	2.91	13.7	1.2
8	China	51/1.84	424	2.25	3997	1.82	9.4	0.8
9	Sweden	19/3.62	374	1.98	5373	2.45	14.4	1.2
10	Netherlands	109/0.95	364	1.93	6729	3.07	18.5	1.6
11	Brazil	120/0.84	330	1.75	2669	1.22	8.1	0.7
12	France	59/1.70	315	1.67	4422	2.02	14.0	1.2
13	South Africa	53/1.82	231	1.22	1968	0.90	8.5	0.7
14	Iran	26/2.68	217	1.15	1085	0.49	5.0	0.4
15	Switzerland	37/2.09	217	1.15	3455	1.58	16.0	1.4
16	Norway	6/6.40	199	1.05	2780	1.27	14.0	1.2
	Sub-total		17139	90.8	204733	93.40	11.9	1.0
	Other 93 countries		1732	9.2	14466	6.60	8.4	0.7
	Total		18871*	100.0	*219199	100.0	11.6	1.00

*Total output and citations are more than the actual numbers, because the method of complete count used by the authors inflates the total number of papers and total citations.

R – Rank of the country in terms of death rates. DR – Death rate per 100,000 of population (Source: www.worldlifeexpectancy.com)

publications to its credit and the third rank was held by Russia with a death rate of 10.73, however, it ranked much lower in terms of research output. The probable reasons behind this substantial variance could be that out of the16 prolific countries listed in Table 2A the majority are scientifically advanced Western entities, have adequate resources to gain insight into the problem afflicting their society, alive to the societal problem of drug abuse and otherwise in the forefront in generating newer scientific knowledge germane to the need of their populace and striving to establish themselves as lead countries in scientific research. Not only that, these countries are democratic societies which tend to shape their policies around the individual wellbeing thereby investing more in research effort with a view to ameliorate peoples' sufferings and ill health. Though China, Iran and South Africa are outside the Western world but they too have built adequate S&T infrastructure. China must be separately mentioned here as an exception having a different political system but strategizing to advance fast in almost all fields of science and technology giving a tough competition to the advanced western countries. Thus despite holding 51st rank among the countries with 1.84 deaths per 100,000 of population, China establishes itself among the scientifically advanced countries which are in the forefront in this area of research. Data presented in Table 2B further reinforces the fact that the incidence of deaths does not have a bearing on the quantum of output. Mostly, the top ranking countries in terms of death rate outside America and Western Europe fall in Africa, Central America and Central Asia and are economically disadvantaged. Some countries despite high death rates listed in the Table 2B have minuscule or nil output. The US and the Western European countries are well endowed with the edifice of robust S&T infrastructure with a corpus of scientific knowledge whereas the same is not the case with African and Central Asian countries listed in the Table 2B for illustration. This makes a case for the prolific scientifically advanced countries to explore the potential of forging research collaboration with these countries marked with high death rates. This would be interesting and revealing to undertake collaborative research which would provide fertile ground in a different, non-western socio-cultural-economic milieu juxtaposed with the scientific prowess of the western world.

Table 2B: Top 50 countries in terms of death rates (DR) per 100,000 Population and their output.

Rank	Country	DR	TNP	Rank	Country	DR	TNP
1	Ukraine	10.96	19	26	Iran	2.68	217
2	USA	10.81	10472	27	Zimbabwe	2.60	3
3	Russia	10.73	43	28	Ghana	2.55	7
4	Belarus	8.23	*	29	Romania	2.42	24
5	Estonia	7.19	8	30	Austria	2.42	90
6	Norway	6.40	199	31	Greece	2.37	56
7	Lithuania	6.14	3	32	N. Korea	2.32	??
8	Finland	5.49	154	33	Peru	2.25	9
9	Nigeria	5.29	29	34	Swaziland	2.24	*
10	Kazakhstan	4.66	*	35	Namibia	2.18	*
11	Australia	4.55	763	36	Togo	2.13	*
12	Kyrgyzstan	4.06	*	37	Switzerland	2.09	216
13	Coted'Ivoire	3.98	3	38	Bolivia	2.00	*
14	Ireland	3.88	106	39	Germany	2.00	522
15	Moldova	3,87	*	40	Mauritania	1.97	*
16	Cameroon	3.77	4	41	Benin	1.97	*
17	Canada	3.73	987	42	Lesotho	1.96	1
18	UK	3.72	829	43	Latvia	1.96	1
19	Sweden	3.62	374	44	Guinea	1.94	*
20	Iceland	3.55	8	45	Iraq	1.90	7
21	Denmark	3.38	181	46	Belgium	1.87	134
22	EquatorialGuinea	3.05	*	47	Tajikistan	1.87	*
23	Cape Verde	2.78	*	48	Mali	1.86	*
24	SierraLeone	2.73	*	49	Turkmenistan	1.86	*
25	Chad	2.73	*	50	Guatemala	1.85	*

*No research output

Distribution of output and impact of prolific institutions

A raw analysis of data indicates that 10,599 institutions scattered in different parts of the globe produced the total output, but mainly concentrated in the USA. Average number of institutions per paper is 3.2. Table 3 lists 56 institutions which produced half per cent or more of the output during 2011–2018. These 56 institutions contributed more than half (58.9%) of the total output and received 49.6% of all the citations. Remaining 10,547 institutions published 41.1% of the total output and obtained about 50.4% of all citations. Of the 56 most productive institutions listed in Table 3 almost all were located in USA except nine institutions which were located in Australia and Canada each three and Brazil, Sweden and UK one each. Among the most prolific institutions University of California Systems produced the highest number of papers, followed by Harvard University and Yale University. The publication output of these prolific institutions was subjected to citation impact analysis in terms of CPP and RCI. As mentioned above, value of CPP for the entire output was 11.6 and for the listed 56 institutions it is 9.8, because the value of CPP for University of Sao Paulo (Brazil) and University of Massachusetts is 9.6 and 9.3 respectively resulting in decrease of CPP for the listed 56 institutions. Except these two institutes the value of CPP for all other institutes was more than 11.6, the value for the entire output. This implies that the research impact of these

Table 3: Impact of the output of most prolific institutions.

#	Institute	TNP	TNP (%)	TNC	TNC (%)	CPP	RCI
1	University California System	1002	5.31	16348	7.46	16.3	1.40
2	Harvard University	498	2.64	10311	4.70	20.7	1.78
3	Yale University	461	2.44	8801	4.02	19.1	1.52
4	Columbia University	397	2.10	6767	3.09	17.1	1.47
5	Johns Hopkins University	375	1.99	6722	3.07	17.9	1.54
6	University of Washington (St. Louis, Private)	331	1.75	5621	2.56	17.0	1.46
7	University Michigan	325	1.72	6620	3.02	20.4	1.76
9	University of Pennsylvania	286	1.52	4286	1.96	15.0	1.29
10	University Maryland	286	1.52	4021	1.83	14.1	1.20
11	University Toronto (Canada)	269	1.43	3892	1.78	14.5	1.24
12	University of North Carolina	264	1.40	3763	1.72	14.3	1.23
13	Boston University	249	1.32	3879	1.77	15.6	1.34
14	University Kentucky	239	1.27	2907	1.33	12.2	1.05
15	Virginia Commonwealth University	233	1.23	3141	1.43	13.5	1.16
16	University Pittsburgh	232	1.23	4851	2.21	20.9	1.80
17	*National Institute on Drug Abuse*	219	1.16	5012	2.29	22.9	1.97
18	Brown University	218	1.16	3122	1.42	14.3	1.22
19	New York University	216	1.14	3712	1.69	17.2	1.48
20	University of Washington (Public funded)	210	1.11	4038	1.84	19.2	1.66
21	Duke University	205	1.09	3476	1.59	17.0	1.46
22	University of London (England)	191	1.01	4332	1.98	22.7	1.96
23	*University* of *Minnesota*	185	0.98	2935	1.34	15.9	1.37
24	Emory University	168	0.89	2264	1.03	13.5	1.46
25	*University* of *Miami*	168	0.89	2230	1.02	13.3	1.15
26	*Oregon Health and Science University*	158	0.84	2398	1.09	15.2	1.30
27	*University* of *Illinois*	157	0.83	4328	1.97	27.6	2.37
28	University of Colorado	157	0.83	3296	1.50	20.1	1.81
29	*Karolinska Institute (Sweden)*	155	0.82	3213	1.47	20.7	1.79
30	*University* of *Connecticut*	155	0.82	2936	1.34	18.9	1.63
31	University of British Columbia (Canada)	152	0.81	2450	1.12	16.1	1.38
32	Stanford University	150	0.79	3319	1.51	22.1	1.91

33	University of Southern California	146	0.77	2260	1.03	15.5	1.34
34	*University* of *Massachusetts*	143	0.76	1334	0.61	9.3	0.80
35	*University* of *Cincinnati*	138	0.73	1934	0.88	14.0	1.21
36	University of South Florida	133	0.70	1714	0.78	12.9	1.11
37	Temple University	123	0.65	1658	0.76	13.5	1.17
38	*UNSW (Australia)	122	0.65	3690	1.68	30.3	2.58
39	Medical University of South Carolina	120	0.64	1960	0.89	16.3	1.39
40	**CDC (USA)	118	0.63	3620	1.65	30.7	2.62
41	Wayne State University	116	0.61	1380	0.63	11.9	1.03
42	Rutgers State University	116	0.61	1517	0.69	13.1	1.13
43	University of New Mexico	116	0.61	1851	0.84	16.0	1.38
44	*University* of *Melbourne (Australia)*	115	0.61	2419	1.10	21.0	1.80
45	University of Arkansas	113	0.60	1856	0.85	16.4	1.42
46	University of Georgia	112	0.59	1195	0.55	10.7	0.93
47	Ohio State University	112	0.59	1603	0.73	14.3	1.24
48	RTI International	112	0.59	1738	0.79	15.5	1.34
49	Mc Gill University (Canada)	109	0.58	1726	0.79	15.8	1.36
50	Monash University (Australia)	109	0.58	1309	0.60	12.0	1.03
51	*University* of *Sao Paulo (Brazil)*	107	0.57	1031	0.47	9.6	0.82
52	*University* of *Texas*	106	0.56	1640	0.75	15.5	1.34
53	***CAMH (Canada)	106	0.56	1395	0.64	13.2	1.14
54	*University* of *Wisconsin*	104	0.55	1647	0.75	15.8	1.36
55	*University* of *Florida*	103	0.55	981	0.45	9.5	0.82
56	Pennsylvania State University	100	0.53	1695	0.77	17.0	1.45
	Sub-total	11110	58.87	108794	49.63	9.8	0.84
	Other institutions	7761	41.13	110405	50.37	14.2	1.22
	Total	18871	100.0	219199	100.0	11.6	1.00

*UNSW: University of New South Wales, **CDC: Centre for Disease Control and Prevention,
*** CAMH: Centre for Addiction and Mental Health

institutions commensurate with their publication output. The value of CPP was highest for CDC (30.7) closely followed by University of New South Wales (Australia). The values of RCI also follow trends similar to CPP, being highest for CDC and UNSW and lowest for University of Sao Paulo (Brazil) and University of Massachusetts.

Distribution of output by prolific authors and impact of their output

Analysis of data indicates that average number of authors per paper is 4.7. Table 4 lists 12 authors who published 35 or more papers. These 12 authors published 530 (3.2%) papers. Rest 96.8% papers were contributed by 50,080 authors indicating a highly scattered output among the authors. The reason for such a high number of authors is because average number of authors per paper is 4.7. Of the 12 most prolific authors, 10 prolific authors were from the USA and two from Sweden. Impact of authors in terms of CPP and RCI indicates that among the listed 12 authors, three authors had lower value of CPP than the global value of CPP. The value of RCI for these authors was also less than one. It implies that the research efforts of these three authors are higher than the impact of their research productivity. Among all the authors listed in Table 4, Altice, Frederick L of the Yale University, New Haven, USA had the highest value of CPP and RCI followed by O'Grady, Kevin E of the University of Maryland, USA. The lowest value of CPP and RCI is for Sundquist, Kristina of the Lund University, Malmo, Sweden.

Distribution of citations and highly cited papers

Citation analysis measures the impact of each article by counting the number of times these are cited by other articles.

Table 4: Most prolific authors and the impact of their output.

S. No.	Authors	Institutions	TNP	TNC	CPP	RCI
1	Altice, Frederick L.	Yale University, New Haven, USA	61	1318	21.6	1.7
2	Rosenheck, Robert.	Yale University, West Haven, USA	59	774	13.1	1.0
3	Kendler, Kenneth S.	Virginia Commonwealth University, USA	57	744	13.1	1.0
4	Petry, Nancy M.	University of Connecticut, USA	48	637	13.3	1.0
5	Sundquist, Kristina	Lund University, Sweden	41	402	9.8	0.8
6	Sundquist, Jan	Lund University, Sweden	40	400	10.0	0.8
7	McCarty, Dennis	Oregon Health and Science University, USA	39	448	11.5	0.9
8	Schwartz, R. P.	Friends Research Institute, USA	38	460	12.1	0.9
9	Tsai, Jack	*MIRECC (US Department of Veterans Affairs)	38	483	12.7	1.0
10	O'Grady, Kevin E.	University of Maryland, USA.	37	676	18.3	1.4
11	Guerrero, Erick G.	University of Southern California, USA	36	381	10.6	0.8
12	Nunes, Edward V.	Columbia University (NY), USA	36	453	12.6	1.0
	Sub-total		530	7176	13.5	-
	Other authors	50,080	18341	212023	11.6	-
	Grand Total	50,092	18871	219199	11.6	1.0

*MIRECC: Mental Illness Research Education and Clinic Centre

Table 5: Distribution of citations.

Number of citations	Number of Papers (%)	Total citations	Number of citations	Number of Papers (%)	Total citations
0	2009 (12.0)	0	11-20	2847 (17.0)	41704
1	1643 (9.8)	1643	21-30	1226 (7.3)	30518
2	1312 (7.8)	2624	31-40	598 (3.6)	20978
3	1127 (6.7)	3381	41-50	363 (2.8)	16425
4	957 (5.7)	3828	51-100	523 (3.1)	35688
5	848 (5.1)	4240	> 100	177 (1.1)	33886
6-10	3115 (18.6)	24284	Total	16745 (100.0)	219199

High levels of citation to a scientific publication are interpreted as signs of scientific influence, impact and visibility. An author's visibility can be measured through a determination of how often his/her publications have been cited in publications by other authors. Table 5 shows the citation pattern of the papers published on drug abuse research during 2011-2018. Citations were examined till 19 June 2019, on which the data were downloaded. During this period, 219,199 citations were received by 18,871 papers and the average rate of CPP was 11.6. Of the total papers included in the analysis, 2009 (12%) did not receive any citation and rest were cited one or more times. Of the 2009 uncited papers, 1802 (10.8%) were published by most prolific countries and the rest 207 papers by other 93 countries. Of the 1802 uncited papers highest (988) were from the USA. Of the total cited papers about one-third (35%) were cited between 1-5 times and 18.6% were cited 6-10 times. Thus, slightly more than half (53.6%) of the papers were cited between 1-10 times. Remaining 46.4% were cited more than 10 times. Of these, about 4.2% papers received more than 50 citations, of which 177 (1.1%) papers received more than 100 citations. Table 6 lists the 16 highly cited authors. These 16 authors received 9771 (4.5%) of all citations. However, it will be important to mention here that none of the highly cited authors is among the prolific authors.

Highly cited papers

Table 6 lists 16 papers which received 300 or more citations. These were produced by authors from three different countries. A raw analysis of data based on the affiliation of the first author it was found that 13 papers were written by authors form USA, two from Australia and one from England. These 16 papers attracted 9971 (4.5%) of all citations. Since the number of citations received varies according to the citation window for which citations were calculated. To normalize this variation in citations, we have calculated Citation per Year (CPY) used earlier by Garg and Tripathi[14] in their study on bibliometrics in India. Analysis of data based on CPY indicates that the rank of authors arranged by citations received changes considerably if arranged by CPY. For instance, author ranked at # 3 will occupy rank #1 and author at rank # 10 will occupy rank #3. Impact factor mentioned against each title indicates that almost all highly cited papers

Table 6: Highly cited papers from different countries.

	Bibliographic details of Highly Cited Papers that received more than 300 citations	TNC	CPY	IF
1	Durlak, J.A., Weissberg, R.P., Dymnicki, A.B., *et al*. The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions, *Child Development* 82(1) 2011, 405–432.	1551	172.4	4.8
2	Goldstein, L.B., Bushnell, C.C.D., Adams, R.J., *et al*. Guidelines for the primary prevention of stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association, *Stroke* 42(2) 2011, 517–584.	937	85.2	5.4
3	Dowell, D., Haegerich, T.M., Chou, R. CDC Guideline for prescribing Opioids for chronic pain - United States, 2016, *MMWR Recommendations and Reports* 65(1) March 18, 2016, 1– 49.	785	196.3	14.5
4	Proctor, E., Silmere, H., Raghavan, R., *et al*. Outcomes for implementation research: Conceptual distinctions, measurement challenges and research agenda, *Administration and Policy in Mental Health and Mental Health Services Research*, 38(2) 2011, 65–76.	744	67.6	2.3
*5	Dalley, J.W., Everitt, B.J., Robbins, T.W., Impulsivity, compulsivity and top-down cognitive control, *Neuron*, 69(4) February 24 2011, 680–694.	605	67.3	13.6
6	Maren, S., Phan, K.L., Liberzon, I., The contextual brain: implications for fear conditioning, extinction and psychopathology, *Nature Reviews Neuroscience*, 14(6) 2013, 417–428.	582	83.1	32.9
**7	Degenhardt, L., Hall. W., Extent of illicit drug use and dependence and their contribution to the global burden of disease, *Lancet*, 379 (9810) January 7 2012, 55–70.	552	69.0	57.8
8	Tye, K.M, Prakash, R., Kim, S.Y., *et al*. Amygdala circuitry mediating reversible and bidirectional control of anxiety,*Nature*, 471 (7338) March 17 2011, 358–362.	532	59.2	42.5
9	Ho, B.C., Andreasen, N.C., Ziebell, S., *et al*. Long-term antipsychotic treatment and brain volumes: A longitudinal study of first-episode schizophrenia, *Archives of General Psychiatry*, 68(2) 2011, 128-137.	519	57.7	3.0$
10	Dart, R.C., Surratt, H.L., Cicero, T.J., *et al*. Trends in opioids analgesic abuse and mortality in the United States, *New England Journal of Medicine*, 372(3) JAN 15, 2015, 241-248.	518	103.6	69.9
11	Salamone, J.D., Correa, M., The mysterious motivational functions of mesolimbic dopamine, *Neuron*, 76(3) November 8 2012, 470-485.	514	64.3	13.6
12	Wager, T.D., Atlas, L.Y., Lindquist, M.A., *et al*. An fMRI-based neurologic signature of physical pain, *New England Journal of Medicine*, 368(15) APR 11, 2013, 1388-1397.	443	63.3	69.9
13	McEwen, B.S., Brain on stress: How the social environment gets under the skin, *Proc. of the National Academy of Sciences of the United States of America*, 109, October 16, 2012, 17180 –17185.	400	50.0	9.3
14	Moghaddam, B., Javitt, D.,From revolution to evolution: The Glutamate hypothesis of schizophrenia and its implication for treatment, *Neuropsychopharmacology*, 37(1) 2012, 4-15.	391	48.8	6.8
15	Cicero, T.J., Ellis, M.S., Surratt, H.L., *et al*. The changing face of Heroin use in the United States A retrospective analysis of the past 50 years, *JAMA Psychiatry*, 71(7) 2014, 821-826.	366	61.0	15.4
**16	Donker, T., Petrie, K., Proudfoot, J., *et al*. Smartphones for smarter delivery of mental health programs: A systematic review, *Journal of Medical Internet Research*, 15(11) 2013, -	332	47.4	4.2

*Authors from UK and ** Authors from Australia, $RG Impact factor

were published in journals with impact factor more than four except two papers where the impact factor of the journal was less than four. Five of these papers were published in journals with impact factor more than 30. This indicates that papers published in high impact factor journals tend to receive more citations than those published in low impact factor journals.

Communication behavior

Scholars publish their work in a wide range of journals, published from different countries of the world. The pattern of communication of the scholars indicates that the total output was scattered among 2469 journals originating from 61 countries. Of these about 84% (2080) journals were published from 10 countries and these journals published 15721 (93.9%) papers and remaining 1024 (6.1%) papers were published in journals originating from 51 countries. More than three-fourth (76.5%) of these journals were published from three countries, namely USA (48.7%) followed by UK (23.1%) and the Netherlands (4.7%). The journals from these three countries published about 69% of all the articles. Table 7 lists 16 journals with the name of publishing country and impact factor of the journals, most commonly used for publishing research results. Of these, eight journals were published from USA, five from the Netherlands, four from the UK and one form Germany. These 16 journals published 19.5% of the total papers and rest 80.5% papers were scattered in 2453 journals

published from different parts of the globe. This indicates that the output in drug abuse research is highly scattered. A raw analysis of data indicates that about 44% of the papers related to drug research were published in journals with impact factor with impact factor more than two. Of these about 8% papers were published in journals with impact factor six or more than six. As reflected by titles of the journals listed in Table 7, 11 journals appear to be directly related to the field of drug abuse.

DISCUSSION AND CONCLUSION

The study provides an insight of global publication trends and citation impact of research output of highly productive countries, besides providing data on death rate and research productivity of top 50 countries in terms of death rate. The study points out a declining trend of output. Data on the distribution of output indicates a highly skewed distribution of research output for countries, institutions and authors. For instance, 16 countries produced about 90% of the total output while only a minuscule portion (10%) of output was produced by large number countries. USA is the most productive country in research related to drug abuse and produced far more scientific papers than European countries. Also USA was found to be most cited country; however, the value of citation impact in terms of citation per paper (CPP) for USA is considerably lower than that of UK and the Netherlands. Most of the prolific institutions were also located in the USA except nine institutions which were located in Australia, Brazil, Canada, Sweden and UK. University of California systems followed by Yale University topped the list of most productive institutions. The value of CPP was highest for Centres for Disease Control and Prevention (CDC) closely followed by University of New South Wales (Australia). Impact of research is not commensurate with their publication output for University of Sao Paulo (Brazil) and University of Massachusetts as these institutions had a lower value of RCI than 1. Most of the prolific and highly cited authors were also from the USA. Analysis of data also indicates that global drug research is highly scattered in terms of language also with English as the main language of communication. Also 93 countries which produced a miniscule portion of the output and have not been listed in Table 2A had a poor citation impact of research output as reflected by their values of CPP and RCI. It is noteworthy to mention here that no highly cited authors were among the prolific authors and all highly cited papers were published in journals with impact factor more than four except two papers where the impact factor was less than four. Five of these papers were published in journals with impact factor more than 30, which indicates that papers published in high impact factor journals tend to receive more citations than those published in low impact factor journals. Like countries, institutions and authors, the output is also

Table 7: Most common journals used for publishing research results.

S.NO	Journal	Country	TNP	IF
1	Drug and Alcohol Dependence	Netherlands	472	3.5
2	Journal of Substance Abuse Treatment	Netherlands	448	2.5
3	Substance Use and Misuse	USA	258	1.1
4	Addictive Behaviors	UK	241	3.0
5	PLoS One	USA	224	2.8
6	Psychopharmacology	Germany	182	3.4
7	Addiction	UK	166	5.8
8	American Journal of Drug and Alcohol Abuse	USA	145	2.2
9	Children and Youth Services Review	UK	139	1.2
10	American Journal on Addictions	USA	128	2.1
11	Psychiatric services	USA	118	2.9
12	Journal of Psychoactive Drugs	UK	116	1.7
13	Substance Abuse	USA	115	2.7
14	Psychiatry Research	Netherlands	108	2.7
15	Psychology of Addictive Behaviors	USA	105	2.5
16	Journal of Affective Disorders	Netherlands	105	3.8
17	Journal of Addiction Medicine	USA	101	2.4
18	Aids And Behavior	Netherlands	100	3.3
	Sub-total		3271	19.5
	Other 2451 Journals		13474	80.5
	Total (2469 Journals)		16745	100

scattered in large number of journals. Most of these journals were published from the USA and the UK. A large proportion of output was published in journals with impact factor ≤ 2. No bearing was observed in the death rates per 100,000 of population and the corresponding proportion of research output. Thus, there exists a need to explore the possibilities of research collaboration between the scientifically advanced countries with the countries ranked higher in terms death rate per 100,000 populations having disproportionately minuscule or no research output. Thus, a mechanism is needed that support research in developing and marginalised economies as drug abuse is also prevalent in these countries.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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