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Medical Waste Research Performance: A Scientometric Study

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ABSTRACT

The medical waste very dangerous to humans, animals, and environment also and it's increased the number of epidemics and waste-related diseases are in the past years. The present study aimsto find out growth of research publications in medical waste, to examine top fifteen institutions contributed in medical waste, to find top fifteen Sources contributions in medical waste. The relevant data have been collected from the Web of Science database. The search string was used 'Medical Waste' in the Title search box, field was used, and the time span field was select from 2003 to 2017. A total of 301 records were retrieved. The medical waste research publications are increasing two times form starting year to end of the study period year. Totally 167 sources were contributed 301 research papers published in this research, among the sources "Waste Management" has first place with 39 records. Totally 996 authors were contributed in this research, amongst Yan JH has occupies first place with 19 papers. The collaborativeauthorcontributed is high compare with Single author contribution. Totally 63 contributed in this research, amongst Peoples R China has first place with 50 publications contributed, India has second place with 29 publications, USA has third place with 28 records. The huge health risks to humans, animals and the environment posed by medical waste, this is a big issue past years. Therefore, the present study identified the growth of publications in medical waste research.

KEYWORDS: Medical waste, Hospital waste, Infections waste,

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INTRODUCTION

Hospitals being the centre of cure are also an important centre of infectious waste generation. Hospitals generate large amount of dangerous waste¹. In the past few years, public concern over the disposal of medical waste has markedly increased. Medical wastes are defined to include all types of wastes produced by health facilities such as general hospitals, medical centres and dispensaries. Medical wastes represent a small amount of total residues generated in a community. "Medical waste" refers to materials generated as a result patient diagnosis, treatment, or immunization of human beings or animals. "Infections waste" refers to that portion of medical waste that could transmit an infectious disease^{2,3}. Hospital waste is a special type of waste produced in small quantities carrying a high potential of infection and injury. Inadequate and improper handling may have serious public health consequences and a significant impact on the environment⁴. Hospital waste consists of both risk waste and non risk waste. Generally, risk waste includes infectious waste, pathological, pharmaceutical, sharps, chemicals, geno-toxic and radioactive wastes. Non-risk waste includes garbage and general day to day waste produced by food stuff leftovers and their packaging⁵. Hospitals are generally indebted to maintain and clean dispose medical waste in order to prevent pollution and infection. There are several scientometric studies have reported analysis of Solid waste, waste management, municipal solid waste, Waste Electrical and Electronic Equipment, agricultural waste, and food waste so far. Hence, the present study attempts to fill this gap by presenting research publications on Medical waste.

METHODOLOGY

The data have been collected from the Web of Science database; the study period is during (2003-2017). The search string was used 'Medical Waste' in the Title search box, field was used, and the time span field was select from 2003 to 2017. A total of 301 records were retrieved, the data downloaded and analyzed using MS office-Excel as per objectives of the present study.

A) Relative Growth Rate (RGT) and Doubling Time (DT)

The relative growth rate is the increase in the number of publications/pages per unit of time. Here, one year is taken as the unit of time. The mean relative growth rate R (1-2) over a specified period of interval can be calculated from the following equation suggested by Mahapatra⁶.

$$R(1-2) = \frac{W2 - W1}{T2 - T1}$$

Where,

R = Mean relative growth rate over the specific period of interval;

W1 = log w1 (Natural log of initial number of publications/ pages);

$W_2 = \log w_2$ (Natural log of initial number of publications/pages);

$T_2 - T_1 =$ Unit difference between the initial time and final time.

Therefore,

$R(a) =$ Relative growth rate per unit of publications per unit of time (year)

$R(p) =$ Relative growth rate per unit of pages per unit of time (year)

B) Doubling Time (DT)

A direct equivalence exists between the relative growth rate and doubling time. If the number of publications/pages of a subject doubles during a given period, then the difference between the logarithms of the numbers at the beginning and at the end of the period must be the logarithms of the number 2. This difference has a value of 0.693. Thus, the corresponding doubling time for publication and pages can be calculated by the following formula:

$$\text{Doubling time (Dt)} = \frac{0.693}{R}$$

Therefore,

$$\text{Doubling time for publications Dt (a)} = \frac{0.693}{R(a)}$$

C) Objectives

- To find out year wise publications in Medical Waste research
- To identify document types contributed in Medical Waste research
- To analysis language wise publications in Medical Waste research
- To examine top fifteen institutions contributed in Medical Waste
- To find top fifteen Sources contributions in Medical Waste
- To identify top fifteen countries contributed in Medical Waste

ANALYSIS AND DISCUSSION

Table 1 year wise research publications in medical waste

Sl.No	Publication Years	Records	Percentages
1	2003	12	3.99
2	2004	7	2.33
3	2005	12	3.99
4	2006	9	2.99
5	2007	12	3.99
6	2008	22	7.31
7	2009	31	10.30
8	2010	17	5.65
9	2011	20	6.65
10	2012	20	6.65
11	2013	23	7.64
12	2014	28	9.30
13	2015	28	9.30
14	2016	24	7.97
15	2017	36	11.96
	Total	301	100.00

Table 1 shows that year wise research publications in medical waste, totally 301 papers were published during the study period. Among the fifteen years 2017 has occupies first place with 11.96 percent of papers, 2009 has second place with 10.30 percent of papers, 2014 and 2015 has third and fifth place with 9.30 percent of publications respectively, followed by 2016 has sixth place with 7.97, in 2013 published 7.64 percent of papers, in 2008 published 7.31 percent of papers, in 2011 and 2012 published 6.65 percent of papers respectively, in 2010 published 5.65 percent of papers published, in 2003, 2005 and 2007 published 3.99 percent of papers, in 2004 published 2.33 percent of paper during the study period. During the study period, in 2004 have published least number of publications.

Table 2 Relative Growth Rate and Doubling Time of medical waste publications

Sl.No	Publication Years	Records	Cumulative	W1	W2	W2-W1 (Ra)	Mean (Ra)	Doubling Time	Mean Dt (a) 1-2
1	2003	12	12		2.48				
2	2004	7	19	2.48	1.94	-0.54		0.28	
3	2005	12	31	1.94	2.48	0.54		0.36	
4	2006	9	40	2.48	2.19	-0.29		0.28	
5	2007	12	52	2.19	2.48	0.29	0	0.32	0.31
6	2008	22	74	2.48	3.09	0.61		0.28	
7	2009	31	105	3.09	3.43	0.34		0.22	
8	2010	17	122	3.43	2.83	-0.6		0.20	
9	2011	20	142	2.83	2.99	0.16		0.24	
10	2012	20	162	2.99	2.99	0	0.1	0.23	0.24
11	2013	23	185	2.99	3.13	0.14		0.23	
12	2014	28	213	3.13	3.33	0.2		0.22	
13	2015	28	241	3.33	3.33	0		0.21	
14	2016	24	265	3.33	3.17	-0.16		0.21	
15	2017	36	301	3.17	3.58	0.41	0.11	0.22	0.22
	Total	301					0.07		0.25

Table 2 shows that, Relative Growth Rate and Doubling Time, during the study period publications Doubling Time mean value is 0.25. In 2003, the medical waste research publication was 12; gradually the research publications were raised to 36 in the year 2017, the relative growth rate mean value is 0.07. The medical waste research publications are increasing two times from starting year to end of the study period year.

Table 3 Document types wise publications in medical waste research

Sl.No	Document types	Records	% of 301
1	Article	250	83.06
2	Editorial Material	16	5.32
3	Meeting Abstract	12	3.99
4	Letter	7	2.33
5	News Item	5	1.66
6	Proceedings Paper	5	1.66
7	Review	4	1.33
8	Correction	1	0.33
9	Reprint	1	0.33
	Total	301	100.00

Table 3 shows that, document type wise publications during the study period in medical waste research. 301 records were contributed nine document types, among the nine documents types, article types has first place with 83.06 percent of papers published, Editorial Material has second place with 5.32 percent of papers published, Meeting Abstract has third place with 3.99 percent of papers published followed by Letter has 2.33 percent, News Item and Proceedings Paper has 1.66 percent respectively, Review has 1.33 percent, Correction and Reprint has 0.33 percent of records published in medical waste research publications.

Table 4 Language wise publications in medical waste research

Sl. No	Languages	Records	% of 301
1	English	285	94.68
2	Portuguese	4	1.33
3	Spanish	4	1.33
4	Polish	3	1.00
5	French	2	0.66
6	Turkish	2	0.66
7	Chinese	1	0.33
	Total	301	100

Table 4 shows that language wise publications in medical waste research, 301 records were contributed only the seven languages, among the seven languages English language contributed 285 papers in this research, Portuguese and Spanish contributed 4 papers respectively, Polish contributed 3 papers, French and Turkish contributed 2 papers respectively only one paper were contributed in Chinese.

Table 5 top fifteen Sources contributed in medical waste research

Sl.No	Source titles	Records	% of 301
1	Waste Management	39	12.96
2	Waste Management Research	23	7.64
3	Journal of Hazardous Materials	10	3.32
4	Fresenius Environmental Bulletin	7	2.33
5	Journal of Environmental Management	5	1.66
6	Chemosphere	4	1.33
7	Journal of Environmental Protection and Ecology	4	1.33
8	Journal of Material Cycles and Waste Management	4	1.33
9	Journal of the Air Waste management Association	4	1.33
10	American Journal of Infection Control	3	1.00
11	BMC Public Health	3	1.00
12	Engenharia Sanitaria e Ambiental	3	1.00
13	Jama Journal of the American Medical Association	3	1.00
14	Journal of Central South University	3	1.00
15	Journal of Cleaner Production	3	1.00

Table 5 shows that top fifteen source contributed in medical waste research publications during the study period, totally 167 sources were contributed 301 research papers published in this research, among the 167 sources only top fifteen sources are, Waste Management has first place with 39 records, Waste Management Research has second place with 23 records, Waste Management Research has third place with 10 records, followed by Fresenius Environmental Bulletin has fourth place with 7 records, Journal of Environmental Management has fifth place with 5 records, Chemosphere, Journal Environmental Protection and Ecology, Journal of Material Cycles and Waste Management, and Journal of the Air Waste management Association has sixth, seventh, eighth, and ninth place respectively, American Journal of Infection Control, BMC Public Health, Engenharia Sanitaria e Ambiental, Jama Journal of the American Medical Association, Journal of Central South University, and Journal of Cleaner Production have tenth, eleventh, twelfth, thirteenth, fourteenth and fifteenth place respectively, remaining 152 sources were contributed two and single contribution of 183 articles in this research.

Table 6 top fifteen authors contributed in medical waste research

Sl.No	Authors	Records	% of 301
1	Yan JH	19	6.31
2	Li XD	13	4.31
3	Lu SY	10	3.32
4	Chen T	7	2.32
5	TaghipourH	6	1.99
6	Cen KF	5	1.66
7	Chi Y	5	1.66
8	O'hareWT	5	1.66
9	PatwaryMA	5	1.66
10	PengZ	5	1.66
11	SarkerMH	5	1.66
12	TakayanaguiAMM	5	1.66
13	Yan M	5	1.66
14	Zhang YF	5	1.66
15	Goren S	4	1.32

Table 6 shows that top fifteen authors contributed in medical waste research, during the study period, totally 996 authors were contributed in this research, among the author top fifteen authors, Yan JH has occupies first place with 19 papers, Li XD has second place with 13 papers, Lu SY has third place with 10 papers, followed by Chen T has fourth place with 7 papers contributed, Taghipour H has contributed 6 papers, Cen KF, Chi Y, O'hare WT, Patwary MA, Peng Z, Sarker MH, Takayanagui AMM, Yan M, Zhang YF has contributed 5 papers respectively, Goren S has contributed 4 papers. Moreover, remaining 981 authors were contributed four and below contributions in this research.

Table 7 authorship pattern in medical waste research

Sl.No	Authorship pattern	No. of papers	Percentages
1	Single Author	46	15.28
2	Double Authors	54	17.94
3	Three authors	53	17.61
4	Four Author	50	16.61
5	Five Author	24	7.97
6	Six and Above Authors	74	24.58
	Total	301	100.00

Table 7 shows that authorship pattern in medical waste research, 301 papers were contributed various authorship pattern, six and above authors collaborative contributed were 74 papers, Double authors collaborative contributed were 54 papers, three authors collaborative contributed were 53 papers, four authors collaborative contributed were 50 papers, single author were contributed 46 papers, and five authors collaborative contributed were 24 papers, in the authorship pattern six and above authors collaborative contributed are high compare with Single author contribution.

Table 8 Top fifteen institutions contributed in medical waste research

Sl.No	Organizations/ Institutions	Records	% of 301
1	Zhejiang University	19	6.31
2	Chinese Academy of Sciences	8	2.65
3	Democritus University of Thrace	8	2.65
4	Tianjin University	7	2.32
5	Tabriz University of Medical Science	6	1.99
6	Universidade De Sao Paulo	6	1.99
7	Jordan University of Science Technology	5	1.66
8	MinistEnvironm Protect	5	1.66
9	Research Center for Eco Environmental Sciences Rcees	5	1.66
10	University of Teesside	5	1.66
11	Fatihuniversity	4	1.32
12	National Cheng Kung University	4	1.32
13	Polish AssocSanit Engineers	4	1.32
14	Universidade Do Porto	4	1.32
15	Yildiz Technical University	4	1.32

Totally 470 sources were contributed 301 papers, The table 8 indicates that top fifteen institutions contributed in medical waste research publications, among the fifteen institutions, Zhejiang University has first place with 19 records, Chinese Academy of Sciences and Democritus University of Thrace has second and third with 8 papers contributed respectively, followed by Tianjin University and has fourth place with 6 records contributed, Tabriz University of Medical Science and Universidade De Sao Paulo has fifth and sixth place with 6 papers contributions, Jordan University of Science Technology, MinistEnvironm Protect, Research Center for Eco Environmental Sciences Rcees., and University of Teesside has seventh, eighth, ninth and tenth place with 5 records, and Fatihuniversity, National Cheng Kung University, Polish AssocSanit Engineers, Universidade Do Porto and Yildiz Technical University has eleventh, twelfth, thirteenth, fourteenth, and fifteenth place with 4 papers contributed in medical waste publication. Moreover, remaining 455 sources were contributed 4 and below contributions in this research during the study period.

Table 9 shows top fifteen countries contributed in medical waste research

Sl.No	Countries/Regions	Records	% of 301
1	Peoples R China	50	16.61
2	India	29	9.63
3	USA	28	9.30
4	Turkey	22	7.30
5	Japan	16	5.31
6	Iran	15	4.98
7	Greece	14	4.65
8	Brazil	12	3.98
9	Taiwan	12	3.98
10	England	11	3.65
11	Poland	10	3.32
12	South Korea	8	2.65
13	Nigeria	6	1.99
14	Bangladesh	5	1.66
15	Canada	5	1.66

Totally 63 contributed in this research, in the table 9 indicates thattop fifteen countries Contributed in medical waste research publications, among the top fifteen countriesinstitutions, Peoples R China has first place with 50 publications contributed,India has second place with 29 publications, USA has third place with 28 records, followed by Turkey has fourth place with 22 records, Japan fifth place with 16 records, Iran has sixth place with 15 records, Greece has seventh 14 records, Brazil and Taiwan has eighth and ninth place with 12 records respectively,England has tenth place with 11 records, Poland has eleventh place with 10 records, South Korea has twelfth place with 8 records, Nigeria has thirteenth place with 6 records,Bangladesh, Canada has fourteenth and fifteenth place with five records respectively.Moreover, the remaining 48 countries were contributed 5 and less than 5 papers published in medical waste researchduring the study period.

Table 10 Sources contributed in medical waste research

Sl.No	Source Titles	Records	% of 301
1	Waste Management	39	12.96
2	Waste Management Research	23	7.64
3	Journal of Hazardous Materials	10	3.32
4	Fresenius Environmental Bulletin	7	2.33
5	Journal of Environmental Management	5	1.66
6	Chemosphere	4	1.33
7	Journal of Environmental Protection and Ecology	4	1.33
8	Journal of Material Cycles and Waste Management	4	1.33
9	Journal of the Air Waste Management Association	4	1.33
10	American Journal of Infection Control	3	1.00
11	BMC Public Health	3	1.00
12	Engenharia Sanitaria E Ambiental	3	1.00
13	JAMA Journal of the American Medical Association	3	1.00
14	Journal of Central South University	3	1.00
15	Journal of Cleaner Production	3	1.00
16	Journal of Clinical and Diagnostic Research	3	1.00
17	waste management	3	1.00
18	27 sources contributed 2	54	17.94
19	123 sources contributed 1	123	40.86
	Total	301	100.00

Totally 183 sources were published 301 papers in medical waste research during the study period, among the 183 sources top fifteen sources were only indicates in the table 10, those top fifteen sources are; Waste Management has first place with 39 papers, Waste Management Research has second place with 23 papers published, Journal of Hazardous Materials has third place with 10 papers published, Fresenius Environmental Bulletin has fourth place with 7 papers published, Journal of Environmental Management has published5 papers, Chemosphere, Journal of Environmental Protection and Ecology, Journal of Material Cycles and Waste Management, Journal of the Air Waste Management Association has sixth, seventh, eighth, and ninth place with 4 papers published respectively, American Journal of Infection Control, BMC Public Health, Engenharia Sanitaria E

Ambiental, JAMA Journal of the American Medical Association, Journal of Central South University, and Journal of Cleaner Production has tenth, eleventh, twelfth, thirteenth, fourteenth and fifteenth place with 3 papers respectively. Moreover, the remaining 152 sources were contributed 183 articles in this research.

CONCLUSION

The present study shown that medical waste research performance, totally 301 papers was published during the study period. Among the fifteens study in the growth of publication rising from 3.99 percent to 11.96 percent of papers in this research. Among the 301 records were contributed only the seven languages, among the seven languages English language contributed 285 papers in this research. Totally 167 sources contributed “Waste Management” has first place with 39 records. Totally 996 authors were contributed in this research, among the author top fifteen authors, Yan JH has occupies first place with 19 papers. The collaborative authors contributed are high compare with single author contribution. Country wise Contributions in medical waste research publications the Peoples R China has first place with 50 publications contributed, India has second place with 29 publications, USA has third place with 28 records.

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