CO-AUTHORSHIP AND CO-OCCURRENCE ANALYSIS WITH VOS VIEWER: A SCIENTOMETRIC VISUALIZATION OF 'GENDER DYSPHORIA' RESEARCH OUTPUT AS INDEXED IN PUBMED (2003-2022)

ABSTRACT

This study explored the co-authorship and co-occurrence dimensions of authors, organizations, author keywords, and MeSH keywords with 2977 documents on 'Gender Dysphoria' retrieved from the PubMed database during 2003-2022, using VOS Viewer. Total Link Strength, Cluster formations, and Network Visualizations are used to understand the inherent dimensions of the given research output.

Keywords : *Gender Dysphoria, PubMed, Co-authorship, Co-occurrences, MeSH Keywords, Total Link Strength*

Introduction

Scientometric studies aim at revealing the research productivity of a chosen person, country, institution, subject domain, and source in terms of annual growth rate, authorship pattern, geo metrics, source metrics, institutional metrics, network visualization, and tenability of classical metric laws. The metric studies disclose the most prolific authors, organizations, countries, sources, and funding agencies in any chosen research output.

Gender Dysphoria

When the gender identity of people gets differ from the gender assigned at birth or due to their gender-related physical characteristics, they develop some kind of feeling of discomfort or distress. This system is known as 'Gender Dysphoria'. Normally, this kind of distress is experienced by transgender people in their life. But, some of them go with ease with their bodies, either with some sort of medical treatment or without any kind of medical assistance.

Symptoms

Most of the time, adolescents and adults could experience a clear-cut difference between inner gender identity and assigned gender because of this Gender Dysphoria problem at least for six months. The difference is shown by at least two of the following:

A difference between gender identity and genitals or secondary sex characteristics, such as breast size, voice, and facial hair. In young adolescents, a difference between gender identity and anticipated secondary sex characteristics.

❖ A strong desire to be rid of these genitals or secondary sex characteristics, or a desire to prevent the development of secondary sex characteristics.

❖ A strong desire to have the genitals and secondary sex characteristics of another gender.

❖ A strong desire to be or to be treated as another gender.

❖ A strong belief in having the typical feelings and reactions of another gender.

Objectives

The objectives of the present study are four-fold. They are:

❖ To explore the co-authorship pattern of authors in 'Gender Dysphoria' research output as indexed in PubMed Database during 2003-2022

❖ To investigate the co-authorship pattern of organizations

❖ To analyze the Co-occurrences of Author keywords

❖ To discover the co-occurrences of MeSH keywords

❖ To present cluster-wise grouping and network visualizations of all the above four indicators.

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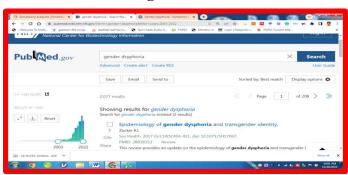*College Librarian*
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Materials and Methods

The research output on 'Gender Dysphoria' which is indexed in the PubMed database as of 18th December 2022 was downloaded as a plaintext file. The period of the study is 2003-2022. A total of 2077 documents were downloaded and considered for analysis. The string 'Gender Dysphoria' was used in the search box of the PubMed Site (https://pubmed.ncbi.nlm.nih.gov/? term = gender + dysphoria & filter = years. 2003-2022). (Figure 1) The downloaded file was imported into VOS Viewer software for drawing required inferences to answer the objectives set for the study.

Figure 1 : Pu

bMed Search

Data Analysis

I. Co-authorship – Authors

Table 1

Total Link Strength of Most prolific authors (>50)

Author	Documents	Total Link Strength
Bouman, Mark-Bram	60	251
Kreukels, Baudewijntje P C	51	201
Mullender, Margriet G	41	200
Cohen-Kettenis, Peggy T	65	196
Den Heijer, Martin	52	184
Van Der Sluis, Wouter B	41	173
Steensma, Thomas D	46	147
De Vries, Annelou L C	43	145
Buncamper, Marlon E	28	142
T'sjoen, Guy	44	139

Van De Grift, Tim C	26	131
Özer, Müjde	21	119
Wiepjes, Chantal M	26	112
Zucker, Kenneth J	35	89
Pigot, Garry L S	16	88
Al-Tamimi, Muhammed	13	81
Vanderlaan, Doug P	23	79
Fisher, Alessandra D	18	76
Lobato, Maria Inês Rodrigues	19	73
Schwarz, Karine	20	73
Elfering, Lian	14	72
Smit, Jan Maerten	12	68
Nota, Nienke M	13	63
Schreiner, Thomas	11	56
Gómez-Gil, Esther	17	55
Castellini, Giovanni	11	53
Elaut, Els	12	52
Fontanari, Anna Martha Vaitses	10	52
Maggi, Mario	13	52

The Total link strength metrics indicate the overall strength of the co-authorship links of a particular faculty/ research fellow/academician with other peer group members. i.e. we calculate the overall link strength of a researcher and compare it with that of other peers to identify how strongly a particular researcher influences the field. Out of 6298 authors, 249 meet the threshold of having a minimum of 5 documents. Bouman, Mark-Bram leads the group with 60 documents and a total link strength of 251 followed by Kreukels with 51 documents and 201 total link strength and Mullender with 41 documents and 200 total link strength. The authors with a total link strength of more than 50 are listed in Table 1.

Table 2
Clustering of Selected Authors (249)

Cluster	No. of Items		Cluster	No. of Items
One	45		19	2
Two	26		20	2
Three	17		21	2
Four	17		22	2
Five	15		23	2
Six	14		24	1
Seven	13		25	1
Eight	13		26	1
Nine	13		27	1
Ten	12		28	1
Eleven	9		29	1
Twelve	8		30	1
13	7		31	1
14	5		32	1
15	4		33	1
16	3		34	1
17	3		35	1
18	2		36	1
Total		249		

Table 2 shows that these 249 authors form themselves into 36 clusters of which the first ten clusters are very strong and active with more than 10 authors in each cluster. The most active cluster has 45 authors and there are dozens of clusters with just one or two authors, revealing the existence of no co-authorship among authors.
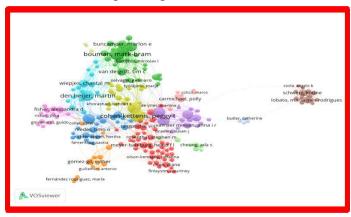

Figure 2: Co-Authorship Analysis of Authors

II. Co-Authorship – Organizations
Total Link Strength of most productive organizations

Out of 5201 organizations, 134 meet the threshold of having published a minimum of 3 documents on Gender Dysphoria. Center Of Expertise On Gender Dysphoria, Vu University Medical Center tops the table with a total link strength of 35 followed by the Department Of Plastic, Reconstructive And Hand Surgery, Vu University Medical Center with a TLS of 29, and the Department Of Endocrinology, Oslo University Hospital, Oslo, Norway with a TLS of 26.

Table 3
Clustering of selected organizations (134)

Cluster	No. of Items		Cluster	No. of Items
One	18		22	2
Two	11		23	2
Three	11		24	1
Four	10		25	1
Five	9		26	1
Six	6		27	1
Seven	5		28	1
Eight	4		29	1
Nine	4		30	1
Ten	4		31	1
Eleven	4		32	1
Twelve	3		33	1
13	3		34	1
14	3		35	1
15	3		36	1
16	3		37	1
17	2		38	1
18	2		39	1
19	2		40	1
20	2		41	1
21	2		42	1
Total		134		

134 organizations have formed 42 clusters, as given in Table 3. The first five clusters are very active with more participating organizations. About two third of the organizations are found to be in clusters where either one or two organizations are available. Thus, many organizations don't coauthor with other organizations to carry out their research on 'Gener Dysphoria'.
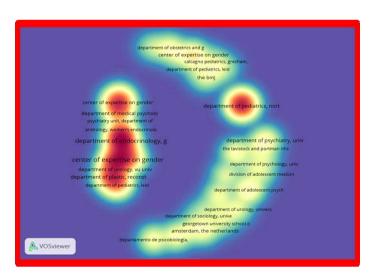
Figure 3: Co-Authorship Analysis of Organizations

III. Co-occurrence: Author Keywords

"Total link strength is an attribute in metric studies. It helps us to measure how a chosen keyword in a database, being studied, co-occurred or linked with all other keywords available in a specific literature output from the same database, in the same time span.

Table 4

Total Link Strength of Author Keywords

Keyword	Occurrences	Total Link Strength
Gender Dysphoria	723	1849
Transgender	488	1354
Gender Identity	150	424
Gender Incongruence	98	344
Transsexualism	74	200
Adolescents	52	177
Mental Health	51	152
Testosterone	53	148
Gender Identity Disorder	46	138
Vaginoplasty	44	123
Adolescent	34	117
Transgender Persons	48	109
Lesbian	16	99

Gay	15	97
Phalloplasty	34	92
Bisexual	14	91
Fertility Preservation	29	89
Transsexual	28	89
Sex Reassignment Surgery	34	88
Adolescence	29	84
Gender	35	84
Gender-Affirming Surgery	28	84
Sexual Orientation	25	80
Depression	26	77
Autism Spectrum Disorder	24	72
Quality Of Life	20	72
Children	19	71
Hormone Therapy	25	71

Out of 2719 keywords, 206 keywords meet the threshold i.e. minimum number of occurrences of a keyword is set as 5. The keywords with more than 70 occurrences are listed in Table 4. The keyword 'Gender Dysphoria' has 723 occurrences with a TLS of 1849 followed by 'Transgender' with a TLS of 1354 and Gender Identify with a TLS of 424.
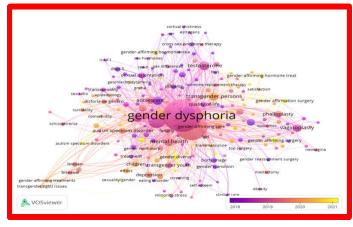

Figure 4: Co-occurrence of Author Keywords

Table 5

Clustering of 206 most occurred Author Keywords

Cluster	No. of Items
One	27
Two	27
Three	26
Four	19
Five	18
Six	17
Seven	15
Eight	14
Nine	14
Ten	12
Eleven	12
Twelve	5
Total	206

206 author keywords are grouped into 12 clusters, as given in Table 5. The first two clusters have 27 author keywords each while the third cluster has 26 keywords and the fourth cluster has 19 keywords.

IV. Co-Occurrence: MeSH Keywords

Table 6

Total Link Strength of MeSH Keywords

Keyword	Occurrences	Total Link Strength
Humans	1671	14610
Female	1291	12574
Male	1287	12468
Transgender Persons	799	7390
Gender Dysphoria	856	7347
Adult	580	6477
Adolescent	620	6446
Gender Identity	575	5185
Transsexualism	494	4905
Young Adult	333	3964
Child	361	3462
Middle Aged	251	3068
Sex Reassignment Surgery	227	2253
Surveys And Questionnaires	172	1983
Sex Reassignment Procedures	174	1960
Retrospective Studies	170	1880
Cross-Sectional Studies	114	1227
Aged	96	1218
Testosterone	107	1172
Treatment Outcome	93	1125
Follow-Up Studies	86	1082
Gonadal Steroid Hormones	96	1039
Sexual Behavior	101	1034

Out of 1744 keywords, 377 meet the threshold of having minimum 5 occurrences. Table 6 shows the MeSH keywords that have occurred in more than 100 documents with a TLR of more than a thousand. The MeSH keywords – Humans, Female, and Male are the most frequently occurring keywords with more than 1000 occurrences scoring TLR of more than ten thousand. Transgender Persons and Gender Dysphoria are the keywords that gained a TLR of 7390 and 7347 respectively.
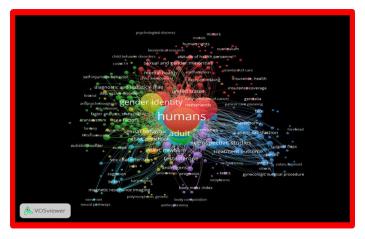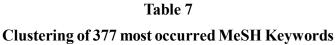

Figure 5: Co-occurrence Analysis of MeSH Keywords

Table 7

Clustering of 377 most occurred MeSH Keywords

Cluster	No. of Items
One	97
Two	87
Three	65
Four	47
Five	36
Six	24
Seven	11
Eight	10
Total	**377**

The shortlisted 377 MeSH keywords have formed 8 clusters, as listed in Table 7. Cluster 1 has 97 keywords cluster two has 87 keywords and cluster 3 has 65 keywords. All eight clusters are active in terms of co-occurrences.

Conclusion

The use of VOS Viewer has brought to light who are the authors and what are the organizations with the highest TLR and which keywords have the highest TLR, which clusters are very active in the above units of study, and a visual representation of both co-authorship and co-occurrence pattern in Gender Dysphoria research output.

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