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SHORT REPORT



Tracking trends of transgender health research online: are researchers and the public on the same page?

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ABSTRACT

Altmetric Explorer was searched for the most popular online articles published in Pubmed-indexed journals. The 75 articles with the highest Altmetric Attention Score (AAS) were screened for article information (date, journal, access), authorship (number of authors, affiliation and origin of the corresponding author), and research (type, subject, funding). The reviewed articles displayed a mean AAS of 241.52, were broadcast 17.03 times by news agencies, posted on Twitter 101.47 times, downloaded by 67.21 Mendeley readers, and received 62.67 citations. There was intense online interest in the transgender health literature, mainly related to mental health and social well-being. Online visibility of transgender health articles was not significantly correlated with citation counts, implying that the public, likely including transgender persons and allies, may place emphasis on different health issues than scholars. Monitoring altmetrics and interactions on electronic media may help researchers conduct research that is more meaningful to transgender individuals, and to society in general.

ARTICLE HISTORY

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KEYWORDS


Transgender; gender dysphoria; altmetrics; citations; bibliometrics

Introduction

Transgender is an umbrella term describing individuals whose gender identity differs from the sex assigned at birth (Human Rights Campaign® 2018). The conflict between physical and expressed genders in childhood may occasionally lead to a medical condition known as ‘gender dysphoria’, which is characterised by serious emotional distress along with a persistent and strong desire to live as the opposite gender (American Psychiatric Association 2013). Contemporary treatment protocols include early puberty suppression with gonadotropin-releasing hormone analogues and cross-sex hormonal treatment at approximately 16 years of age, possibly followed by surgical treatment in legal adulthood (Bockting et al. 2012; Hembree et al. 2017; Kaltiala-Heino et al. 2018).

The size of the transgender population seems to be understudied due to the lack of standardised survey items on population-based surveys (Wilson, Sharp and Carr 1999; De

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Cuyper et al. 2007; Kuyper and Wijsen 2014; Arcelus et al. 2015; Van Caenegem et al. 2015; Collin et al. 2016) as well as ethnic and linguistic diversity within societies (Haas et al. 2010). Based on new federal and state data, about 1.4 million adults in the USA or 0.6% of the adult population, identify as transgender persons (Flores et al. 2016). As transgender adolescents are increasingly coming out, the actual size of this population might be larger than currently estimated (Chipkin and Kim 2017). Therefore, the sufficiency of healthcare infrastructure and hosting services for transgender people might be questioned.

To increase public awareness, several researchers have conducted research on the health needs of transgender individuals (Sweileh 2018). Despite the progress made, transgender individuals are still confronted with social burdens and disturbing patterns of mistreatment and discrimination in education, employment, family life, health, housing and criminal justice system (James et al. 2016). Further research has been recommended to understand sexual behaviour beyond the gender binary, investigate the social determinants of health disparities, and improve living standards among members of the transgender community (Connolly et al. 2016).

Peer-reviewed literature in transgender health has grown rapidly over the last few years in bibliometric terms. In a recent study, the publication rate was shown to have increased by 30.9% between 2016 and 2017, while retrieved documents obtained up to 524 citations per document and an h-index of 92 (Sweileh 2018). Nonetheless, traditional citation metrics, like citation counts, journal impact factor (IF) and the h-index, can be heavily inflated, slow to accumulate, and cannot appraise the social impact of scholarly work (Priem et al. 2010).

In today's era of electronic publishing and social media, the dissemination of articles through blogs, podcasts, social network platforms and news media can be measured with article-level metrics defined as 'altmetrics' (Priem, Groth and Taraborelli 2012; Trueger et al. 2015). These new metrics capture the influence of a given article among broader audiences as early as a few minutes after appearing online (Elmore 2018). High online visibility of an article may draw attention to the publishing journal, to the authors and the target study group (Chavda and Patel 2016), which, in the case of transgender persons, might improve health knowledge and social acceptance.

Other than researchers, social media are being broadly used by transgender people and allies to discuss about health and social concerns (Krueger and Young 2015). To date, public engagement with transgender research articles on the Web has not been investigated. Thus, this study aimed to measure the online interactions triggered by transgender research on electronic platforms by identifying the most discussed topics online, and investigating associations between altmetrics, traditional citation-based metrics, and article features.

Materials and methods

Search engine

For the purposes of the study, Altmetric Explorer (AE, Altmetric LLP, London, UK) was used, a monitoring service that tracks the attention that research outputs receive online. The electronic sources examined include social media like Twitter, Facebook and Google+; traditional media, both mainstream and field specific; blogs administered by major organisations and individual researchers; as well as online reference managers



Figure 1. The Altmetric donut summarizes the dissemination of a research output through different sources (colors). Altmetric Attention Score is presented in the center of the graphic. The thickness of the stripes indicates the frequency of mentions in each source, which may vary depending on how often the article is mentioned.

such as Mendeley and CiteULike (Altmetric Support 2018). After aggregating and processing all data, the Altmetric database generates a weighted estimate within a colored circle, the Altmetric Attention Score (AAS), offering a quantitative measure of the type and amount of attention that the output has received (Figure 1).

Search strategy

An advanced search was performed on Altmetric Explorer (<https://www.altmetric.com/explorer/outputs>) for research articles on a single date using the following terms: “transgender”, “transsexual”, “gender dysphoria” and “LGBT”. These terms have been partly used in previous systematic reviews on transgender persons (Costa and Colizzi 2016; Wanta and Unger 2017; Baral et al. 2013). No language and time limitations were set regarding publication date and Altmetric mentions. Altmetric Explorer was accessed via an institutional subscription.

Data collection

Altmetric Explorer computed lists containing all research outputs that received AAS together with a summary of the mentions on all screened electronic resources in a .csv file for each search. The 100 top-Altmetric results from each search were compiled and sorted by AAS in descending order. Besides AAS, numbers of mentions by news agencies, Twitter posts and Mendeley readers were also collected. Articles’ abstracts and full-text availability were examined by entering each article title into the PubMed search box (<https://www.ncbi.nlm.nih.gov/pubmed/>).

Two examiners retrieved on a consensus basis the following information in a standardised way (Livas and Delli 2018): (i) article title, (ii) journal title, (iii) time interval since publication date, i.e. up to 1 year, >1 and up to 2 years, >2 and up to 5 years, >5 and up to 10 years, >10 years, (iv) number of authors, (v) number of affiliations, (vi) type of the affiliation of the first author, i.e. university, other, combination, (vii) article origin (as determined by the first author), i.e. North America, Europe, other, (viii) article type, i.e. original research, review article, case report/series, other, (ix) article subject, i.e. education, healthcare needs/disparities, mental health/psychology,

mortality/suicidality, neurology, sociology, treatment, other, (x) full-text availability, i.e. free full text or subscription required, and (xi) funding, i.e. study funded or not.

Citation counts and journal impact factors were extracted from Scopus (<https://www.scopus.com>) and 2017 Journal Citation Reports (<https://clarivate.com/>), respectively.

Statistical analysis

Analysis was carried out with IBM SPSS Statistics 23 (SPSS, Chicago, IL, USA). Mean values and standard deviations (SD) were calculated for AAS, electronic resources, Scopus citations and authorship characteristics. Independent samples t-test or one-way ANOVA were used to compare differences in AAS between the different groups of articles. Pearson correlation coefficients were used to analyse the relationship between AAS and the number of citations in Scopus. Correlations (r) <0.3 were interpreted as a poor association, 0.3 – 0.5 as low, 0.5 – 0.7 as moderate, 0.7 – 0.9 as high, and >0.9 as very high (Hinkle, Wiersma and Jurs 2003). The significance level for all statistical tests conducted was set to $p < 0.05$. Bonferroni correction for multiple comparisons was used.

Results

The four-term search initially yielded 4,243 results. After combining the search results, the first 100 articles in AAS ranking were screened for eligibility. After excluding duplicates, articles not published in journals, and ones not indexed in PubMed, 75 were imported for data analysis. The component 'transgender' was traced in 49 out of 75 article titles, followed by 'transsexual' (11 times), 'gender dysphoria' (9 times), and 'LGBT' (6 times).

The examined articles scored mean AAS of 241.52 (SD: 276.22), were broadcast 17.03 times by news agencies (SD: 24.55), were tweeted 101.47 times (SD: 143.48), and downloaded by 67.21 Mendeley readers (SD: 72.11) (see online Supplemental Table 1). Regarding Scopus citations, transgender articles were cited by scholars 62.67 times (SD: 109.36).

The most popular article according to Altmetric Explorer, a 2011 follow-up study on reassignment surgery in Sweden published in PLoS One (Dhejne et al. 2011), was assigned an AAS of 1,553, made 152 news stories and 569 tweets, and was read by 58 Mendeley users. The same article ranked 11th in Scopus citation counts.

Almost 70% of the entries (52 out of 75) were original research articles, while the most popular subjects were mental health/psychology (14 entries), followed by mortality/suicidality, sociology and healthcare issues with 11 entries each. Funding was acknowledged in 45 entries.

Regarding authorship, on average 4.55 authors (SD: 3.63) and 2.84 affiliations (SD: 1.79) were involved. Fifty-one studies originated from North America, 16 from Europe, and 8 from the rest of the world. Thirty-three out of the 75 articles had been published 2–5 years before the search date on Altmetric Explorer.

The *Journal of Adolescent Health* had published the most articles ($n = 6$), followed by *The Journal of Clinical Endocrinology & Metabolism* ($n = 5$), the *American Journal of Public Health*, the *Journal of Homosexuality*, the *Journal of the American Academy of*



Table 1. Overview of Altmetric Attention Score (AAS) in relation to publication characteristics.

	N	Mean AAS	SD	SE	95% CI for Mean			Minimum	Maximum
					Lower Bound	Upper Bound			
number of authors									
1	12	228.75	154.462	44.589	130.61	326.89	99	627	
2-3	17	224.35	242.641	58.849	99.60	349.11	111	1139	
4	16	235.25	258.009	64.502	97.77	372.73	97	1156	
5-6	17	254.88	341.261	82.768	79.42	430.34	108	1553	
>6	13	266.00	360.712	100.044	48.02	483.98	109	1455	
number of affiliations									
1	19	214.47	133.374	30.598	150.19	278.76	99	627	
2-3	33	223.61	243.366	42.365	137.31	309.90	106	1156	
>3	23	289.57	390.399	81.404	120.74	458.39	97	1553	
author affiliation									
1	19	214.47	133.374	30.598	150.19	278.76	99	627	
2-3	33	223.61	243.366	42.365	137.31	309.90	106	1156	
>3	23	289.57	390.399	81.404	120.74	458.39	97	1553	
article origin									
North America	23	289.57	390.399	81.404	120.74	458.39	97	1553	
Great Britain	51	219.82	212.041	29.692	160.19	279.46	97	1156	
rest of the world	16	257.00	351.080	87.770	69.92	444.08	111	1553	
article type									
original research	8	348.88	451.841	159.750	-28.87	726.62	109	1455	
review	52	241.33	296.878	41.170	158.68	323.98	106	1553	
case report/series	6	160.00	73.889	30.165	82.46	237.54	97	296	
other	4	391.00	499.625	249.812	-404.01	1186.01	111	1139	
article subject									
mortality/suicidality	13	233.92	142.872	39.626	147.59	320.26	99	627	
mental health/ psychology	11	330.82	415.539	125.290	51.66	609.98	110	1553	
healthcare needs/disparities	14	352.36	416.123	111.214	112.09	592.62	113	1455	
treatment	11	214.64	144.840	43.671	117.33	311.94	112	627	
neurology	6	166.67	83.123	33.935	79.43	253.90	120	335	
sociology	9	164.67	46.666	15.555	128.80	200.54	112	246	
education	11	163.91	72.839	21.962	114.98	212.84	97	350	
other	7	138.14	48.852	18.464	92.96	183.32	99	208	
full-text availability									
free	6	321.50	401.326	163.841	-99.67	742.67	109	1139	
subscription needed	47	257.11	291.335	42.496	171.57	342.65	106	1553	
funding	28	215.36	251.751	47.576	117.74	312.98	97	1455	
no funding	45	252.49	316.629	47.200	157.36	347.61	106	1553	
Total	30	225.07	205.225	37.469	148.43	301.70	97	1139	
	75	241.52	276.222	31.895	177.97	305.07	97	1553	

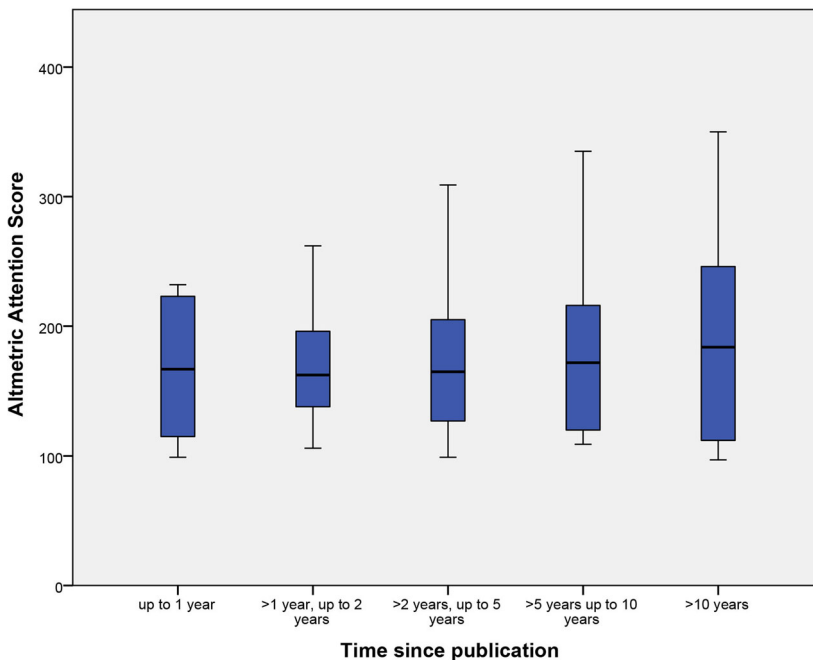


Figure 2. Box plots illustrating the distribution of Altmetric Attention Score per time interval since publication date (of note: outliers are not shown).

Child & Adolescent Psychiatry, and *Pediatrics* with 4 entries each. Subscription was required to 67 journals, while access to 47 articles was free online.

Detailed data regarding the distribution of AAS in relation to publication characteristics are shown in Table 1. No significant differences were observed between AAS and publication characteristics in relation to time interval since publication date (Figure 2), number of authors, number of affiliations, type of the affiliation of the first author, article origin (as determined by the first author), article type (Figure 3), article subject (Figure 4), full-text availability, and funding.

No significant correlation was found between AAS and Scopus citations ($r=0.01$; $p=0.99$). As shown in Figure 4, studies about neurological topics were the most frequently cited ones, while studies about mental health and psychology were the ones getting the highest AAS.

Discussion

Overall, this study demonstrated the intense interest of Web media in transgender health as recorded by the Altmetric Explorer. Seventy-one out of 75 articles fell in the top of 5% of all research outputs scored by altmetric.com, namely 11.4 million outputs including articles, book chapters, data sets, clinical trial records and news stories (Altmetric Explorer 2018). The highest AAS identified in the current transgender study outpaces the top-scores achieved by peer-reviewed publications in emergency and general radiology (which feature at 25 and 264, respectively) (Barbic et al. 2016; Rosenkrantz et al. 2017). Comparable (1,307) or twice as high AAS (3,215) scores have

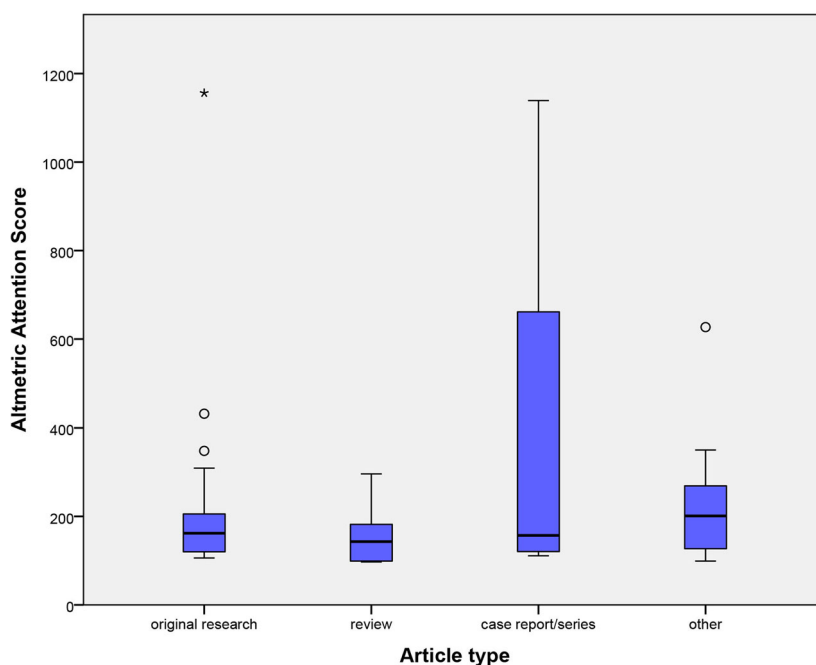


Figure 3. Box plots illustrating the distribution of Altmetric Attention Score per article type (of note: outliers are not shown).

been recently reported for oral cancer and stroke articles (Hassona et al. 2019; Kim et al. 2019), respectively.

In line with bibliometric analyses in other scientific fields, there was no significant correlation between AAS and Scopus citations (Livas and Delli 2018; Peters et al. 2016; Delli et al. 2017; Ruan et al. 2018). In other words, top-Altmetric articles were not more highly cited by scholars than less popular articles online. Other authors have found weak evidence of an association between altmetrics and traditional citations in biomedical sciences (Thelwall et al. 2013; Barbic et al. 2016; Amath et al. 2017), while a positive relationship between tweets and citation rates was observed elsewhere (Peoples et al. 2016; Hughes, Hughes and Murphy 2017; Moradi et al. 2016). It seems that electronic media audiences place greater value on different issues compared to the scientific community. Given the abovementioned inconsistencies and the early stage of altmetrics, AAS scores might usefully be combined with citation-based metrics and number of downloads by institutions, publishers and funding bodies to provide a more inclusive picture of an article's impact (Elmore 2018).

The presence of leading medical journals in the top-75 list such as the *New England Journal of Medicine* with an IF of 72.406 demonstrates the increased productivity of transgender health research attracting the attention of editors of prestigious periodicals. It is noteworthy that the median IF of the journals which published transgender articles was 3.93, whereas more than one-fifth of the articles were published in journals with IF > 10.

There were no significant differences in AAS between articles regarding publication date, origin of the first author, and research type. Interestingly, 70 of the reviewed

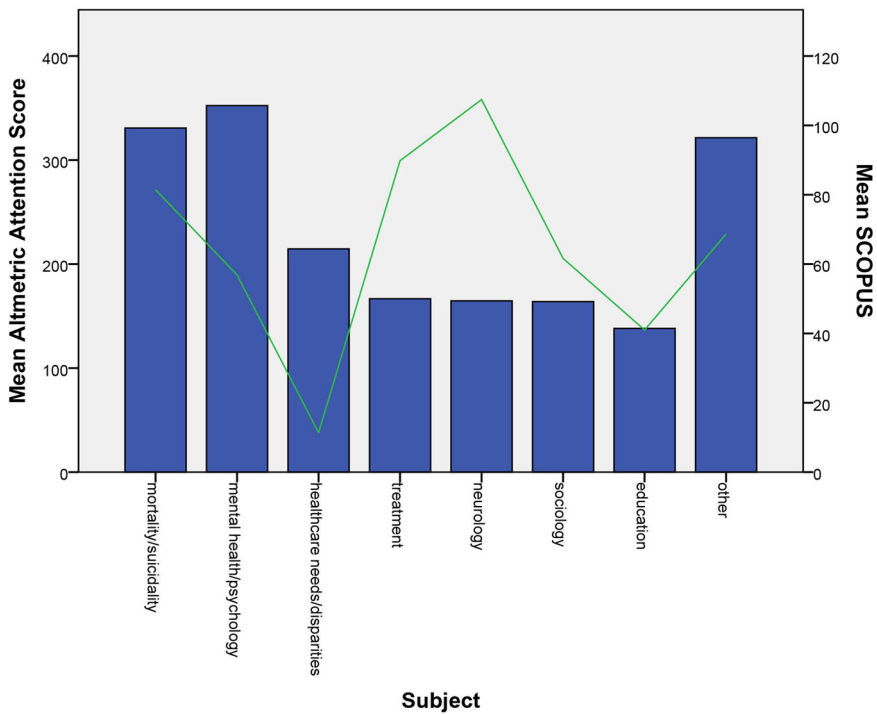


Figure 4. Mean Altmetric Attention Score (blue bars) and mean number of Scopus citations (green circles) per article subject category.

articles had been published after 2008. This period coincides with the evident growth of research in transgender health (Sweileh 2018). Articles published between 2009 and 2018 scored the best AAS contrary to other Altmetric studies (Peters et al. 2016; Delli et al. 2017), where online mentions reached their peak during the first 2 years after publication. Differences in AAS have been identified among disciplines and may be commonly expected (Livas and Delli 2018). Like in earlier research (Sweileh 2018; Moradi et al. 2016), most authors and institutions were located in North America and Europe. In contrast to Moradi et al. (2016), however, we found that the number of non-empirical publications, i.e. theoretical or conceptual papers, literature reviews and case presentations did not exceed the number of original research articles. Perspectives articles and editorials accounted for half of the articles published in journals with an IF of 10 or more but only one of them made it to the top-10. Nevertheless, papers with a low level of evidence, such as case reports and case series, attracted more online attention compared to others, confirming the typical reading preferences of lay audiences.

Half of the research outputs examined the well-being of transgender persons in terms of mental health/psychology, mortality/suicidality rates and social aspects. Mental health was also the topic most frequently investigated in studies of transgender youth populations (i.e. in 11 out of 25 studies). This might reflect the information needs of online media and networks users regarding mental health issues of transgender persons in adolescence. Psychopathological symptoms such as depression, anxiety disorders, self-harm

and suicidal ideation/behaviour have been massively diagnosed in adolescents attending specialised gender identity services (Kaltiala-Heino et al. 2018).

Discrepancies in healthcare infrastructure and practices were among the most trending topics, and prevailed in journals with 10+ IF. Healthcare issues such as lack of training and cultural sensitivity of professionals, lack of acceptability in healthcare settings, and lack of information regarding available resources are perceived by transgender persons as major barriers to healthcare decisions (Aylagas-Crespillo et al. 2017). As neurology (e.g. brain studies) and treatment procedure articles appeared to receive the highest citations but scored the lowest AAS, it can be assumed that scholars and the public may have different interests and priorities in seeking information about transgender individuals. In the eyes of laypersons, the relevance of findings to everyday life, for example the provision of healthcare services, weighed more than complicated scientific discoveries in neuroscience.

While the largest part of LGBT literature published during the period 1950–2007 was disease-specific and devoted to HIV and AIDS (Boehmer 2002; Snyder 2011), barely two articles (33 and 70 in the list) dealt with sexually transmitted infections among transgender people.

Limitations

The limitations of the search strategy should be kept in mind when interpreting the results. Transgender terminology is dynamically evolving to embrace different local, national and global communities (Reisner et al. 2016). Despite the breadth of the acronym 'LGBT' regarding gender diversity, it was intentionally included in the search to avoid underrepresentation of aspects of the available transgender literature. It has previously been shown that up to 60% of LGBT-entitled publications might be solely related to transgender issues (Moradi et al. 2016; Boehmer 2002; Blumer et al. 2012). Since the transgender health literature may grow both as a separate field and a part of research focus within LGBT spectrum (Sweileh 2018), a more global search strategy should be preferred to expand the list of results.

Furthermore, while the selected search terms are widely cited in the international scientific literature, they are not exclusive. Given 'gender identities are complex and fluid' (Baral et al. 2013), we aimed to provide an overall impression of transgender research publications and not to overanalyse gender variance.

Additionally, this study focused on peer-reviewed journals uploaded from one main-stream database (PubMed), and not the whole transgender health literature.

Finally, like in any cross-sectional study, data were collected at a single point in time. Hypothetically, Altmetric rankings may have differed if repeated observations had been made. Future longitudinal Altmetric studies will depict more completely the social impact of the transgender literature and the research interests of online media users on transgender issues.

Future research

Our findings suggest that the social and mental health well-being of transgender individuals may deserve more attention in future research. By filtering online popularity

metrics and comments, researchers and funders can implement research that matches the needs and expectations of transgender persons as well as larger society.

Conclusions

Transgender health research appears widely discussed on electronic media. Most of the articles dealt with mental health/psychology, mortality/suicidality and social topics. The online popularity of transgender articles is not significantly correlated with citation and publication characteristics, indicating a possible discrepancy in information seeking behaviour between scholars and lay Web users.

Disclosure statement

No potential conflict of interest was reported by the authors.

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