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Citation bias in reported smoking prevalence in people with schizophrenia

Simon Chapman, Mark Ragg, Kevin McGeechan

Objective: A meta-analysis of 42 studies on tobacco smoking among schizophrenia subjects found an average smoking prevalence of 62% (range = 14–88%). Statements are common, however, in the research literature and the media that between 80% and 90% of people with schizophrenia smoke. The purpose of the present paper was therefore to determine if citation bias exists in the over-citation and reportage of studies finding high rates of smoking prevalence in schizophrenia subjects.

Methods: Two hypotheses were tested: (i) that studies on the prevalence of smoking in people with schizophrenia reporting high smoking rates would be cited more often than studies reporting lower rates; and (ii) that statements about smoking rates among schizophrenic people on the Internet would report very high rates more often than more realistic, less dramatic rates.

Results: A 10% increase in reported prevalence of smoking was associated with a 61% (95% confidence interval (CI) = 30–98%) increase in citation rate. Journal impact factor (IF) was significantly associated with citation rate ($p = 0.001$) but the country in which a study was carried out did not have an effect ($p = 0.90$). After adjusting for IF, a 10% increase in prevalence of smoking was associated with a 28% increase (95%CI = 1–62%) in citation rate. This bias is mirrored on the Internet, where statements about about uncommonly highly rates of smoking by people with schizophrenia.

Conclusions: Studies reporting very high prevalence of smoking among people with schizophrenia are cited more often than those studies reporting a low prevalence, a result consistent with citation bias. This citation bias probably contributes to the misinformation available on the Internet, and may have adverse policy and clinical implications.

Key words: citation bias, Internet, schizophrenia, smoking, worldwide web.

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'Do you have any idea how much schizophrenics smoke? Tons. It's unbelievable.' <http://thestoneoftear.blogspot.com/2007/07/denialism-blog-shows-some-bad-science.html>

The most recent review of studies reporting on smoking and schizophrenia among both outpatients and inpatients showed that the pooled prevalence of

smoking in people with schizophrenia in published studies across 20 nations was 62%, with a range of 14–88% [1]. A smoking prevalence of >80% was found in 6/42 (14.3%) of the studies, with the numbers of smoking patients in these six studies totalling 484/4686 (10.3%) of all smokers in the studies. We have observed, however, in the introductory and discussion sections of research literature and in press reports and websites that smoking prevalence in people with schizophrenia is often reported as being much higher, frequently 'around', 'up to' or 'about' 90%, a level markedly higher than the average 62% when the 42 studies were pooled. A

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recent widely publicized report on smoking by people with mental illness in Australia [2] recycled the same statement ('People with schizophrenia in particular have extremely high rates of smoking, with most studies finding a prevalence rate of about 90%') [3].

Citation bias is the selective citation of published results to support the findings, arguments or interests of authors and those funding their work [4]. Journal prestige and impact factors [5] are common contributors to citation bias [6], and there are associations between authors' nationality and ethnicity and the country of the journals in which they publish [7–9].

We were curious to determine whether citation bias exists in research literature on the reporting of the prevalence of smoking in people with schizophrenia. We were also curious to determine whether websites tend to report higher rates of smoking by people with schizophrenia than lower, more realistic rates.

We examined evidence relevant to the consideration of two hypotheses: (i) that studies on the prevalence of smoking in people with schizophrenia that found high rates of smoking would be cited more often than studies showing lower rates of smoking; and (ii) that statements about smoking rates among people with schizophrenia on the Internet would report extremely high rates instead of more realistic, less dramatic rates.

Methods

Hypothesis 1

On 26 September 2008, total and average per year citation counts for all 42 studies included by de Leon and Diaz [1] in their 2005 meta-analysis of global studies showing the prevalence of smoking in samples of people with schizophrenia were obtained from the Web of Science. Negative binomial regression was used to estimate the association between the number of citations and the reported prevalence of smoking in people with schizophrenia. The log of the number of years since publication was included in the model as offset. We also examined whether the country where the study was carried out (USA vs elsewhere), and whether the prestige of the journal in which studies were published (measured by average journal impact factor obtained from Journal Citation Reports for 2002–2006) was associated with the number of citations per year.

Hypothesis 2

'What percent of schizophrenics smoke?' was entered into the Google search engine, and the contents of the first two screens (i.e. 20 links) returned were examined. Eighty-eight per cent of web traffic has been observed to go to the first five results returned from online searches [10].

Results

Hypothesis 1

Table 1 shows citations for all 42 studies of smoking prevalence among people with schizophrenia reviewed by de Leon and Diaz [1].

A 10% increase in the reported prevalence of smoking was associated with a 61% (95% confidence interval (CI) = 30–98%) increase in the rate at which a paper was cited. The country of study did not have an effect on the citation rate ($p = 0.90$), after adjusting for journal impact factor. Journal impact factor was significantly related to citation rate ($p = 0.001$), with the rate at which a paper was cited increasing by 32% (95% CI = 12–56%) for an increase in impact factor of 1. After adjustment for impact factor, a 10% increase in the reported prevalence of smoking was associated with a 28% increase (95% CI = 1–62%) in the rate at which a paper is cited. The prevalence of smoking was also moderately associated with impact factor (Spearman rank correlation = 0.44, $p = 0.004$).

Hypothesis 2

Table 2 shows relevant excerpts from the first 20 sites returned from the search string 'what percent of schizophrenics smoke?' entered into Google. Nine sites referred to a smoking prevalence of at least 80%, with a further six including a prevalence of at least 80% within their range. Only two accurately referred to prevalence being around 60%.

Discussion

Papers reporting a high prevalence of smoking among people with schizophrenia are cited more often than studies showing a lower prevalence, providing confirmatory evidence of citation bias favouring higher prevalence studies.

The citation bias existed independently of country of study. This result was reduced when impact factor was taken into account, although it remained statistically significant. Papers reporting higher smoking prevalence rates tended to be published in journals with higher impact factors. This may indicate a publication bias, whereby authors of such studies anticipate high interest in startling reports, which might be reciprocated in editors seeing such papers as potentially newsworthy. There is an association between the news value of research and its subsequent downloading and citation rates [11].

The present study takes evidence about citation bias a step further by showing how this bias toward scientific citation of higher rates of smoking is also reflected in publicly accessible information about smoking by people with schizophrenia. With Google

Table 1. Citations for all 42 studies of smoking prevalence among people with schizophrenia reviewed by de Leon and Diaz [1]

First author	Year published	Average IF of journal, 2002-2006	Country of study	Smoking prevalence	Total citations	Citations per year	Citations since 2006 (% of all citations)
Prevalence \geq 70%							
13 studies. Median annual citations 4.0							
Hughes	1986	7.537	USA	88	539	24.5	101 (18.7)
Chiles	1993	0	USA	88	10	0.67	0
Masterton	1984	4.672	Ireland	87	95	3.96	11 (11.6)
de Leon	1995	7.537	USA	85	204	15.69	46 (22.5)
de Leon	2002	3.932	USA	83	45	7.5	21 (46.7)
Carvajal	1989	0	Chile	81	8	0.42	0
Patkar	2002	1.623	USA	76	15	2.5	9 (60.0)
de Leon	2002	3.932	USA	75	37	6.17	16 (43.2)
Fowler	1998	3.133	Australia	74	115	11.5	30 (26.1)
Goff	1994	7.537	USA	74	257	18.36	52 (20.2)
Gerber	2003	0	Canada	71	2	0	0
Etter	2004	3.133	Switzerland	70	7	1.75	6 (85.7)
LLerena	2003	3.932	Spain	70	0	0	0
Prevalence 60-69%							
14 studies. Median annual citations 3.1							
Gurpegui	2005	3.932	Spain	69	4	1	4 (100)
Combs	2000	3.932	USA	69	15	1.88	5 (33.3)
Ziedonis	1994	2.314	USA	68	122	8.71	27 (22.1)
Arias-Horcajadas	1997	0	Spain	67	0	0	0
Poirier	2002	0	France	66	31	5.17	27 (87.1)
Margolese	2004	3.932	Canada	66	38	9.5	33 (50.0)
McCreadie	2002	4.672	Scotland	65	44	7.33	22 (50.0)
Vanable	2003	0	USA	64	11	2.2	7 (63.6)
Herrán	2000	3.932	Spain	64	35	4.38	16 (45.7)
Challis	1999	2.169	Canada	63	2	0.2	0
Brown	1999	3.230	England	62	192	21.33	98 (51.0)
El Guebaly	1992	2.169	Canada	61	31	1.94	3 (9.7)
Himelhoch	2004	7.537	USA	61	16	4	15 (93.8)
Salokangas	2000	0	Finland	61	9	0	0
Prevalence 50-59%							
Six studies. Median annual citations 1.3							
Beratis	2001	1.753	Greece	58	33	4.71	16 (48.5)
Taiminen	1998	0	Finland	56	22	2.2	10 (45.6)
Tanskanen	1998	1.317	Finland	55	7	0.64	0
LLerena	2003	3.932	Spain	53	0	0	0
Sandyk	1991	0.665	USA	51	28	1.65	4 (19.0)
Uzen	2003	2.904	Turkey	50	6	1	3 (50.0)
Prevalence <50%							
Nine studies. Median annual citations 1.4							
Bejerot	2003	1.988	Sweden	49	8	1.6	7 (87.5)
Steinert	1996	0	Germany	47	4	0.31	1 (25.0)
Itkin	2001	4.938	Israel	45	18	2.57	6 (33.3)
Liao	2002	0	Taiwan	41	6	1.5	4 (66.7)

Table 1. Continued

First author	Year published	Average IF of journal, 2002-2006	Country of study	Smoking prevalence	Total citations	Citations per year	Citations since 2006 (% of all citations)
Mori	2003	1.988	Japan	34	7	1.4	4 (57.1)
Chong	1996	1.526	Singapore	32	24	1.85	4 (16.7)
Campo	2004	0	Colombia	26	2	0.5	0
Ghisays	1996	0	Colombia	26	3	0.25	0
Suarez	1996	0	Colombia	14	2	0.17	0

IF, impact factor.; References to all studies are in Table 1 of [1].

returns dominated by links showing statements of ultra-high smoking prevalence, the public as well as health professionals could be forgiven for believing that the prevalence of smoking in people with schizophrenia is 'about 90%'.

Where does this figure come from? We can only presume that it originates from a small but highly influential early paper by Hughes *et al.*, which showed the prevalence of smoking in a sample of people with schizophrenia to be 88% [12]. This finding derived from a sample of only 24 people with schizophrenia living in one US city and attending a hospital outpatient service in 1981-1982. Researchers have since cited the paper often (n = 539), with peak citations occurring in 2005: 23 years after the data were collected, despite its age and small sample size. Among the 21 citations to the Hughes *et al* paper made in 2008 (27 years after data collection) was a statement in *Physiological Reviews* that 'it has been shown that people with schizophrenia smoke cigarettes at a very high rate, ~80-90% compared with the 45-70% of patients with other psychiatric disorders and 30% of the general population' [13].

In many nations, smoking prevalence in the general population has fallen markedly in recent decades. In Australia for example, the proportion of adults who smoke at least weekly has halved from 36% in 1980 [14] to 17.9% in 2007 [15]. If, today, researchers or journalists were to routinely refer to smoking prevalence today as being 36%, such grossly incorrect statements would be strongly criticized as ill-informed. An apparent propensity for researchers and commentators to erroneously 'talk up' smoking rates in people with schizophrenia is therefore noteworthy and the 'around 90% smoke' may qualify as a 'factoid': 'a spurious (unverified, incorrect, or invented) 'fact' intended to create or prolong public exposure or to manipulate public opinion' (<http://en.wikipedia.org/wiki/Factoid>).

Some authors have also inflated the figures. For example, a 2004 review stated: 'patients with schizophrenia smoke at nearly three times the rate of the general population, with most studies finding prevalence rates of about 90%' [16], and cited three supportive references that all reported smoking prevalence of below 90% [12,17,18].

Since 2005 researchers have had the opportunity to cite the de Leon and Diaz meta-analysis with its mean 62% smoking prevalence. It has so far attracted a creditable 70 citations: still considerably less than the Hughes *et al.* 1986 study, which continues to be the highest cited paper (with 101 citations since 2006).

Table 2. Statements on smoking prevalence among people with schizophrenia contained in the first screen returned for Google search string 'What percent of schizophrenics smoke?'

1.	'prevalence [of smoking] among people with schizophrenia is ... almost 90%' (http://www.schizophrenia.com/smokereport.htm)
2.	'the extraordinarily high incidence of smoking in individuals with schizophrenia—about 85 percent of patients smoke' (http://www.sciam.com/article.cfm?id=smoking-away-schizophreni)
3.	'75 to 85 percent of people with schizophrenia smoke' (http://www.nida.nih.gov/NIDA_notes/NNvol20N5/Bupropion.html)
4.	(no relevant statement) (http://ezinearticles.com/index.php?Smoking-Pot-Can-Lead-To-Schizophrenia&id=963202http://linkinghub.elsevier.com/retrieve/pii/S0920996406002489)
5.	'As many as 90 percent of schizophrenic patients smoke' (http://www.sciencedaily.com/releases/2000/11/001117071535.htm)
6.	'Up to 88 percent of patients with schizophrenia are nicotine-dependent.' (http://psychiatry.jwatch.org/cgi/content/full/2000/1219/5)
7.	'reported rates for people with schizophrenia range between 62 percent and 81 percent.' (http://psychservices.psychiatryonline.org/cgi/content/full/49/7/925)
8.	'individuals with schizophrenia, among whom the smoking rate is 70 percent to 88 percent.' (http://pn.psychiatryonline.org/cgi/content/full/41/23/22?maxtoshw=&HITS=&hits=&RESULTFORMAT=&andorexactitle=&andandorexactitleabs=&and&fulltext=schizophrenia&andorexactfulltext=&and&searchid=1&FIRSTINDEX=0&fdate=//&resourcetype=HWCIT)
9.	'People with schizophrenia are addicted to nicotine at three times the rate of the general population (75–90 percent vs. 25–30 percent)' (http://www.nimh.nih.gov/health/publications/schizophrenia/what-causes-schizophrenia.shtml)
10.	'The frequency of current smoking for the total, schizophrenic and non-schizophrenic samples were respectively 71, 75, and 55%' (http://linkinghub.elsevier.com/retrieve/pii/S092099640100192X)
11.	'80 to 90 percent of people with schizophrenia smoke regularly' (http://www.zacharyodette.com/problems.shtml)
12.	'at least 60 percent of schizophrenics smoke cigarettes' (http://clinicaltrials.gov/ct2/show/NCT00218218).
13.	'As many as 90 percent of schizophrenics smoke' (http://www.writeforit.com/WritingSamples/WritingSample_Features_UpInSmoke.html)
14.	'People with serious mental illnesses, including schizophrenia, smoke at rates between 45 and 88 percent' (http://century.yale.edu/news/saccostudy.html)
15.	'a high percentage of schizophrenics smoke cigarettes to alleviate their symptoms.' (http://www.realitysandwich.com/smoking_schizophrenics)
16.	'61% of people with schizophrenia.. smoke' (http://www.qualitymeasures.ahrq.gov/summary/summary.aspx?doc_id=7766)
17.	'Multiple studies have shown the incidence of smoking among schizophrenics to range from 75% to 90%' (http://www.medscape.com/viewarticle/420848)
18.	'70 percent to 90 percent of schizophrenics ... are smokers' (http://query.nytimes.com/gst/fullpage.html?res=990CE3DF173CF93AA25751C0A963958260)
19.	'The prevalence of ever and current daily smoking was respectively 92 and 83% for patients with schizophrenia' (http://linkinghub.elsevier.com/retrieve/pii/S0920996401002171)
20.	'cigarette use hovers near 90 percent among schizophrenics' (http://psychcentral.com/blog/archives/2006/01/26/nicotine-found-to-help-symptoms-of-schizophrenia/)

From 2006 to the present, the 42 studies in the de Leon and Diaz meta-analysis have been cited 589 times.

The de Leon and Diaz meta-analysis drew heavily on clinical populations. There are few general population estimates of smoking prevalence among those with schizophrenia, but a US study of data from 1991–1992 found current smoking rates for respondents with no mental illness, lifetime non-affective psychosis, and past-month non-affective psychosis of 22.5%, 49.4%, and 45.3%, respectively. Those with a history of mental illness also had substantial quit rates [19]. A recent 11 year follow up of a Canadian sample of outpatients with schizophrenia found that smoking prevalence had fallen from 63.2% in 1995 to 43.3% in 2006, a rate of decline highly favourable compared with cessation rates in the wider Canadian

community [20]. Notions that people with schizophrenia almost all smoke and that their smoking is intractable are therefore contestable.

Nonetheless, people with schizophrenia are seldom advised to quit smoking [21,22] and are sometimes advised not to do so [23,24], despite evidence that they are interested in cessation [25]. Governments do not run campaigns and seldom allocate resources to help them quit. Too often, doctors and nurses think that it is reasonable for mentally ill patients to smoke, because somehow the same concerns about the health and welfare costs of smoking are implied to not apply [26]. Too often, people in psychiatric hospitals are given cigarettes to keep them calm, or as staff bonding gestures [27].

It is possible that an important reinforcer of the higher than average rates of smoking among those

with schizophrenia in most countries is the ubiquity of the 90% factoid. If such a large percentage of those with schizophrenia are assumed to smoke, then many would reason that it must be somehow intrinsic to their disease. If their smoking is explained by their disease, then health professionals may believe that there is little they can do about it, and that there is no point in trying. Sociocultural and contextual factors relevant to an understanding of smoking among people with schizophrenia can remain unexamined. We believe that erroneous assumptions about the near inevitability of smoking in people with schizophrenia may reinforce institutional and clinical neglect of this stigmatized group of people and stultify innovation in targeted smoking cessation. Although it is possible that the repetition of the 'around 90%' factoid may be motivated by a well-meaning concern to magnify the severity of the issue to attract support or funding, uncritical recitation of statements about misleadingly high smoking rates in schizophrenia patients should be challenged.

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