A disease in search of a cause: a study of self-citation and press release pronouncement in the factoid of wind farms causing "vibroacoustic disease".

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ABSTRACT

Background

In recent years, claims have proliferated that wind turbines cause a large variety of diseases. Two of these, "Wind Turbine Syndrome" (WTS) and "Vibroacoustic disease" (VAD) are frequently mentioned. Seventeen reviews of the evidence for wind turbines causing harm have concluded the evidence to be poor yet some regulatory authorities are now referencing health concerns as part of the rationale for set-back guidelines from residences, greatly reducing siting opportunities.

Methods and Findings

Google returns 158,000 hits for WTS and 298,000 for VAD. We conducted a search for all papers and citations on WTS or VAD, and searched for evidence for any association between wind turbine exposure and VAD. No papers on WTS were found in indexed journals. Thirty five papers on VAD were found, none reporting on an association between VAD and wind turbines. Of the 35 papers on VAD, 34 had a first author from a single Portuguese research group. Seventy four per cent of citations to these papers were self-citations by the group. Median self-citation rates in science are around 7%. Two unpublished case reports presented at conferences were found alleging that VAD was "irrefutably demonstrated" to be caused by wind turbines.

Conclusions

VAD has received virtually no scientific recognition beyond the group who invented the term. The claim that wind turbines cause VAD is a factoid that has gone "viral" in cyberspace and may be contributing to nocebo effects among those living near turbines.

Modern wind farms began to be constructed from the early 1980s[1], yet opposition to them based on claims about putative adverse acute and chronic health impacts among those living near them is relatively recent, with unpublished reports being circulated from around 2002, more than 20 years later [2,3]. In the years since, a multitude of claims about the health effects of wind turbine infrasound on humans, mammals, birds and even earthworms have proliferated in cyberspace. A recent collection of such complaints lists 105 symptoms, diseases and aberrant behaviours said to be caused by exposure to wind turbines[4]. Despite 17 reviews and enquiries concurring that the evidence for harm is poor[5], concerns about health have been recently named by an Australian political party as part of its reasoning for mandating 2km minimum turbine set-back regulations from residences should it attain government [6]. A 2011 Australian Senate enquiry into the Social and Economic Impact of Rural Wind Farms and a New South Wales public enquiry into proposed 2km setbacks (2012) received many submissions from people claiming to have symptoms and diseases caused or exacerbated by wind turbines[7,8]. Health concerns have also been prominent in opposition to turbines in parts of Canada [9], the USA [10] and the United Kingdom [11], and some 527 opposition groups across 23 European nations[12].

Vibroacoustic disease

"Wind Turbine Syndrome" and "Vibroacoustic Disease" (VAD) are two diseases that opponents of wind farms attribute to turbine exposure. Wind Turbine Syndrome was coined by a US campaigner against wind farms, Nina Pierpont, in a vanity press published book [13] and while being the most common "disease" constellation being attributed to turbine exposure in wind farms opponents' writings, a PubMed search for "wind turbine syndrome" (30 April 2012) returned zero reports. "Vibroacoustic Disease" is another effect promoted by wind farm opponents, and is regularly included in the litanies of ills said to arise from exposure. For example, in a recent submission to New South Wales Planning's Wind Farm Draft Guidelines, the NSW Landscape Guardians, a group opposed to wind farms, wrote:

"Another source of health concern in relation to wind turbine infrasound is the work of Alves-Pereira and Castelo Branco, the specialists in Vibro-acoustic disease. They have shown that infrasound levels from a wind farm at a residence were higher than infrasound levels at a residence near a port grain terminal, known to be connected with cases of Vibro-acoustic disease."[14]. A Google search (30 April 2012) of the terms "vibro-acoustic" or "vibroacoustic and "disease" and "wind" returned 298,000 webpages, ad "wind turbine syndrome" 158,000.

A group of Portuguese researchers have used Vibroacoustic Disease to describe a whole-body, multi-system pathology, said to be caused by chronic exposure to large pressure amplitude and low frequency noise with level greater than 90 dB SPL, frequency 0 to 500 Hz[15-21]. The research group claims there are three stages in the progression of the disease [16-19] – see Table 1. These were developed from data on 140 male aircraft technicians, with exposure time referring to the time it took for 50% of subjects to develop the corresponding sign or symptom.

In 2010, the UK's Health Protection Agency reviewed the evidence on infrasound and health, concluding: "there is no evidence that infrasound at levels normally encountered in

the environment will lead to the development of vibroacoustic disease. Further this disease itself has not gained clinical recognition… The available data do not suggest that exposure to infrasound below the hearing threshold levels is capable of causing adverse effects."[22].

We were interested in the extent to which VAD and its alleged association with wind turbine exposure had received scientific attention and in how the alleged association with wind turbines gained traction among opponents of wind farms.

Methods

In April 2012, a search using the following terms: "vibroacoustic" OR "vibro-acoustic" AND "disease" AND "wind" was undertaken of Medline, Premedline, Scopus and Web of Science. No publications were found. We then removed the term "wind" in order to assess the extent of the literature on VAD. Original and review articles were included if they included vibroacoustic disease in the title or abstract. Letters to editors and conference abstracts were excluded.

An author self-citation analysis was then undertaken for all papers retrieved. Self-citation is defined as citation where the citing and cited paper share at least one author [23]. Self-citation can be useful as it allows research groups to contextualise their earlier investigations and highlight previous findings [23]. However, self-citation can also artificially increase the apparent scientific impact of a researcher's work and has been shown to increase an author's the H-index by up to 24%)[23,24]. Studies of self-citation rates across disciplines have found median rates of around 7% [25,26]. Lower profile journals tend to have higher self-citation rates [27]. Asknes (2003) examined self-citation rates of 42,004 articles, with 71% having one or more self-citations. The average self-citation rate was 21% [28].

Our analysis included diachronous and synchronous self-citation rates. Synchronous self – citations are those contained in the reference list of a paper and diachronous self-citations are those included in the citations a paper receives [29]. Three bibliometric databases allow calculation of self-citation in their analysis tools (Scopus, Web of Science and Google Scholar). For the citations part of our study, Scopus was used as it retrieves more citations than Web of Science and has greater accuracy in calculating self-citations than Web of Science and Google Scholar [26]. To determine synchronous self-citation rates, the reference list of each article was reviewed.

Results

The search strategy retrieved 182 papers, screening of article title and abstracts was undertaken, resulting in exclusion of 62 articles which did not refer to "vibroacoustic disease" but used the term vibroacoustic in relation to either fetal ultrasound measurement or occupational measurement of noise (Figure 1). A total of 35 papers were found on vibroacoustic disease (Figure 1). Of these, all but one had a first author from one Portuguese research group. The 35 papers were published in journals with impact factors ranging from 0.36 – 3.96. (Table 2).

The total reference count for the 35 papers was 1223 with 650 (53%) of these self-citations (by any of the authors). The 35 papers had 550 citations and 144 after removal of self-citations, giving a self-citation rate across all papers of 74%. Table 3 shows the diachronous

author self citations rates for the two leading authors in the group Castelo Branco (a surgical pathologist) (69%) and Alves-Pereira (an engineer) (36%).

Wind turbines and VAD

The claim about wind turbines causing VAD was first made by the Lisbon group in a paper describing two case studies, presented at the Internoise 2007 conference in Istanbul in late August 2007 [30]. However, they issued a press release some three months earlier on May 31, 2007 stating: "These results *irrefutably demonstrate* [our emphasis] that wind turbines in the proximity of residential areas produce acoustical environments that can lead to the development of VAD (vibroacoustic disease) in nearby home-dwellers."[14] This claimed association was repeated by Alves-Pereira in an invited video-linked presentation to an Australian National Health and Medical Research Council (NHMRC) Wind Farms and Human Health Scientific Forum held on June 7, 2011 [31]. In this presentation she focussed on a case study of one family in a house adjacent to a wind farm. Slide #23 shows an arrow indicating the house concerned. It can be seen that there are many other houses in the area adjacent to the turbines, but her research group conducted no investigations of the residents in any of these, as would be expected in any elementary epidemiological investigation. The boy in the house was having problems of losing interest at school (a very common problem) and Alves-Pereira claimed that wind turbine exposure was a plausible explanation. Remarkably, no other possible explanations of the boy's problems at school were considered or apparently investigated.

Alves-Pereira also referred to problems of "boxy" or "club" foot found in four horses kept at the property (slide #28). This problem too, she suggested might be connected with exposure to wind turbines. She explained that of five young horses examined, four had boxy foot. The one that did not was acquired rather than bred on the farm. One other acquired horse also had boxy foot. Boxy foot is a common problem in horses and has many causes [32] yet none of these were mentioned nor investigated.

Discussion

Across 35 papers, the Lisbon research group is almost entirely responsible for propagating the "disease" entity of vibroacoustic disease, self-citing at extraordinary rates seldom seen in any research field [26,28], with only one in four citations to their body of work being by others. With a hiatus of now 5 years since their last papers on VAD [17,19], there has been no further work published by other researchers, suggesting the disease was never taken seriously by others and has now "died".

The subjects in these 35 papers were mostly aviation workers exposed to noise, including sub-audible infrasound. Linking wind turbine exposure to VAD, a disease that virtually no one else in science even acknowledges, occurred through the two unpublished case studies described which were of frankly abject methodological quality, failing the most elementary tests of epidemiological investigation.

Our findings raise questions about the judgement of the Australian NHMRC in inviting Alves-Pereira to speak at an official forum on wind turbines and health. The aim of the forum, as described by the NHMRC forum chair, was to focus on evidence, published science and hear from international experts. The NHMRC chairperson declared that Alves-Pereira had been

asked to present "to provide international scientific evidence relating to the possible health impacts of wind farms" [31]. Her speaker's biographical note stated "Alves-Pereira, in discussion with physicians Amanda Harry in the U.K. and Nina Pierpont in the U.S., is now looking into the low-frequency noise and infrasound produced by industrial wind turbines, to determine whether they, too, can cause such vibroacoustic disease (VAD)[33]. Alves-Pereira's initial assessment based on noise measurements taken inside and outside the homes of wind turbine neighbours, is that turbines are indeed a likely cause of VAD." [33]. Again, this "assessment" would appear to have been based on measurements taken at just two houses, with no comparison measures taken in houses not adjacent to wind turbines and no investigations conducted into other possible causes of the symptoms described [30,31]. There are many natural and artificial sources of infrasound other than wind turbines. These include wind, storms, ocean waves, refrigerators, sub-woofers, pumps, compressors, low speed fans and trains [22] and even respiration, heartbeat and coughing.

Factoids are questionable or spurious statements presented as facts, but which have no veracity. With some 298,000 mentions in cyberspace, the connection between VAD and wind turbines has gone "viral" is now routinely included in submissions to governments by anti-wind farms activists and mentioned in media interviews. "Vibroacoustic disease" resonates with a portentousness that seems likely to contribute to nocebo effects among those hearing about it and assuming it to be an established disease classification, acknowledged in medicine. The cyberspace-megaphoned relationship between VAD and wind turbine exposure is a classic example of a contemporary factoid, which was spread by a single press release containing the astonishing claim that on the basis of two case studies, the association was "irrefutably demonstrate[d]". Vibroacoustic disease should be considered a candidate for the archives of "non-diseases" [34]. In this case, this factoid is contributing to a regulatory environment which is severely limiting the siting of wind turbines in Australia and elsewhere. Wind turbines have the potential to make further major contributions to renewable energy generation, and thereby to reduce greenhouse gas emissions. By naming and frequently publicising two "diseases" (Wind Turbine Syndrome and Vibroacoustic Disease), those concerned to oppose the proliferation of wind turbines have sought to pull what are often extremely common symptoms and diagnoses (eg: hypertension, poor sleeping patterns, mental health problems) into memorable, quasi-scientific sounding entities.

Author Contributions SC conceived of the project and contributed to the writing; AStG conducted the bibliographic searching and contributed to the writing.

Competing Interests: SC is a member of the Expert Advisory Panel of the Climate and Health Alliance, Australia; ASTG no competing interests declared.

References

1 Sorensen, B. History of, and recent progress in, wind-energy utilization. *Annual Review of Energy and the Environment* **20**, 387-424 (1995).

2 Harry, A. *Wind Turbines, Noise and Health*, <http://www.wind-watch.org/documents/wind-turbines-noise-and-health > (2007).

3 Laurie, S. *Waubra Foundation Presentation 29 November 2011*, <www.centralregion.sa.gov.au/_literature_82343/Dr_Sarah_Laurie> (2011).

4 Simonetti, T. & Chapman, S. *Is there anything not caused by wind turbines?*, <http://tobacco.health.usyd.edu.au/assets/pdfs/publications/WindfarmDiseases.docx> (2011).

5 Simonetti, T. & Chapman, S. *Summary of main conclusions reached in 17 reviews of the research literature on wind farms and health.* , <http://tobacco.health.usyd.edu.au/assets/pdfs/WindHealthReviews.docx> (2011).

6 Wills, D. *Liberals to ban wind farms within 2km of homes*, < http://www.adelaidenow.com.au/news/south-australia/liberals-to-ban-wind-farms-within-2km-of-homes/story-e6frea83-1226237791196> (2012).

7 The Senate: Community Affairs References Committee. (ed Commonwealth of Australia) (Senate Printing Unit, Parliament House, Canberra, 2011).

8 NSW Government Planning & Infrastructure. *Draft NSW Planning Guidelines: Wind Farms*, <http://www.planning.nsw.gov.au/Development/Onexhibition/tabid/205/ctl/View/mid/1081/ID/66/language/en-AU/Default.aspx> (2012).

9 Chief Medical Officer of Health (CMOH) Report Ontario. *The potential health impact of wind turbines*, <http://www.health.gov.on.ca/en/public/publications/ministry_reports/wind_turbine/wind_turbine.pdf> (2010).

10 Ellenbogen, J. M. *et al. Wind Turbine Health Impact Study. Report of Independent Expert Panel. Prepared for: Massachusetts Department of Environmental Protection. Massachusetts Department of Health*, <http://www.mass.gov/dep/energy/wind/turbine_impact_study.pdf> (2012).

11 Hayes Mckenzie Partnership Ltd. Report for Department of Trade and Industry. United Kingdom. *Low Frequency Noise Report. The measurement of low frequency noise at three UK wind farms*, <http://www.berr.gov.uk/files/file31270.pdf> (2006).

12 European platform against windfarms. *European platform against windfarms*, <http://www.epaw.org/> (2012).

13 Pierpont, N. *Wind Turbine Syndrome. A report on a natural experiment*, 2009).

14 Alves-Pereira, M. *Industrial Wind Turbines, Infrasound and Vibroacoustic Disease (VAD): Press Release May 31 2007*, <http://docs.wind-watch.org/vad-press-release-070531.pdf> (2007).

15 Castelo Branco, N. A. & Rodriguez, E. The vibroacoustic disease--an emerging pathology. *Aviation Space & Environmental Medicine* **70**, A1-6 (1999).

16 Castelo Branco, N. A. The clinical stages of vibroacoustic disease. *Aviation Space & Environmental Medicine* **70**, A32-39 (1999).

17 Branco, N. A. A. C., Ferreira, J. R. & Alves-Pereira, M. Respiratory pathology in vibroacoustic disease: 25 years of research. *Revista Portuguesa de Pneumologia* **13**, 129-135 (2007).

18 Branco, N. A. A. C. & Alves-Pereira, M. Vibroacoustic disease. *Noise & Health* **6**, 3-20 (2004).

19 Alves-Pereira, M. & Castelo Branco, N. A. A. Vibroacoustic disease: Biological effects of infrasound and low-frequency noise explained by mechanotransduction cellular signalling. *Progress in Biophysics and Molecular Biology* **93**, 256-279 (2007).

20 Alves-Pereira, M. *et al.* Noise and the respiratory system. *Revista Portuguesa de Pneumologia* **9**, 367-379 (2003).

21 Ferreira, J. R. *et al.* Involvement of central airways in vibroacoustic disease patients. *Revista Portuguesa de Pneumologia* **12**, 93-105 (2006).

22 Health Protection Agency. *Health effects of exposure to ultrasound and infrasound. Report of the independent advisory group on non-ionising radiation*, <www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1265028759369> (

23 Couto, F. M., Pesquita, C., Grego, T. & Verissimo, P. Handling self-citations using Google Scholar. *Cybometrics* **13**, 1-7 (2009).

24 Kelly, C. D. & Jennions, M. D. The h index and career assessment by numbers. *Trends in Ecology & Evolution* **21**, 167-170 (2006).

25 Hyland, K. Self-citation and self-reference: Credibility and promotion in academic publication. *Journal of the American Society for Information Science and Technology* **54**, 251-259 (2003).

26 Kulkarni, A. V., Aziz, B., Shams, I. & Busse, J. W. Author self-citation in the general medicine literature. *PLoS ONE* **6** (2011). <http://www.scopus.com/inward/record.url?eid=2-s2.0-79959242890&partnerID=40&md5=1442e21af9eeec849e3e7e1098487766>.

27 Fassoulaki, A., Papilas, K., Paraskeva, A. & Patris, K. Impact factor bias and proposed adjustments for its determination. *Acta Anaesthesiologica Scandinavica* **46**, 902-905 (2002).

28 Aksnes, D. W. A macro study of self-citation. *Scientometrics* **56**, 235-246 (2003).

29 Lawani, S. M. On the heterogenity and classification of author self-citations. *Journal of the American Society for Information Science* **33**, 280-284 (1982).

30 Alves-Pereira, M. & Castelo Branco, N. A. A. *Internoise Conference Paper: Public health and noise exposure: the importance of low frequency noise*, <www.dfld.de/Downloads/PublichealthAndNoiseExposure.pdf> (2007).

31 National Health and Medical Research Council. *Wind Farms and Human Health Scientific Forum - 7 June 2011. (M. Alves-Pereira presentation commences at 1hr15m44s)*, <http://gigtv.rampms.com/gigtv/Viewer/?peid=be168fd6def644f094410c09c8e684b51d> (2011).

32 Dyson, S., Murray, R., Blunden, T. & Schramme, M. Current concepts of navicular disease. *Equine Veterinary Education* **18**, 45-56, doi:10.1111/j.2042-3292.2006.tb00414.x (2006).

33 National Health and Medical Research Council. *Wind Turbines Scientific Forum - Brief CVs International Presenters*, <http://www.nhmrc.gov.au/_files_nhmrc/file/media/events/wind_farms_scientific_forum_speakers_june_2011.pdf> (2011).

34 Smith, R. In search of "non-disease. *British Medical Journal* **324**, 883-885 (2002).

Figure 1. Search Results for "Vibroacoustic Disease" and Wind Farms/Turbines

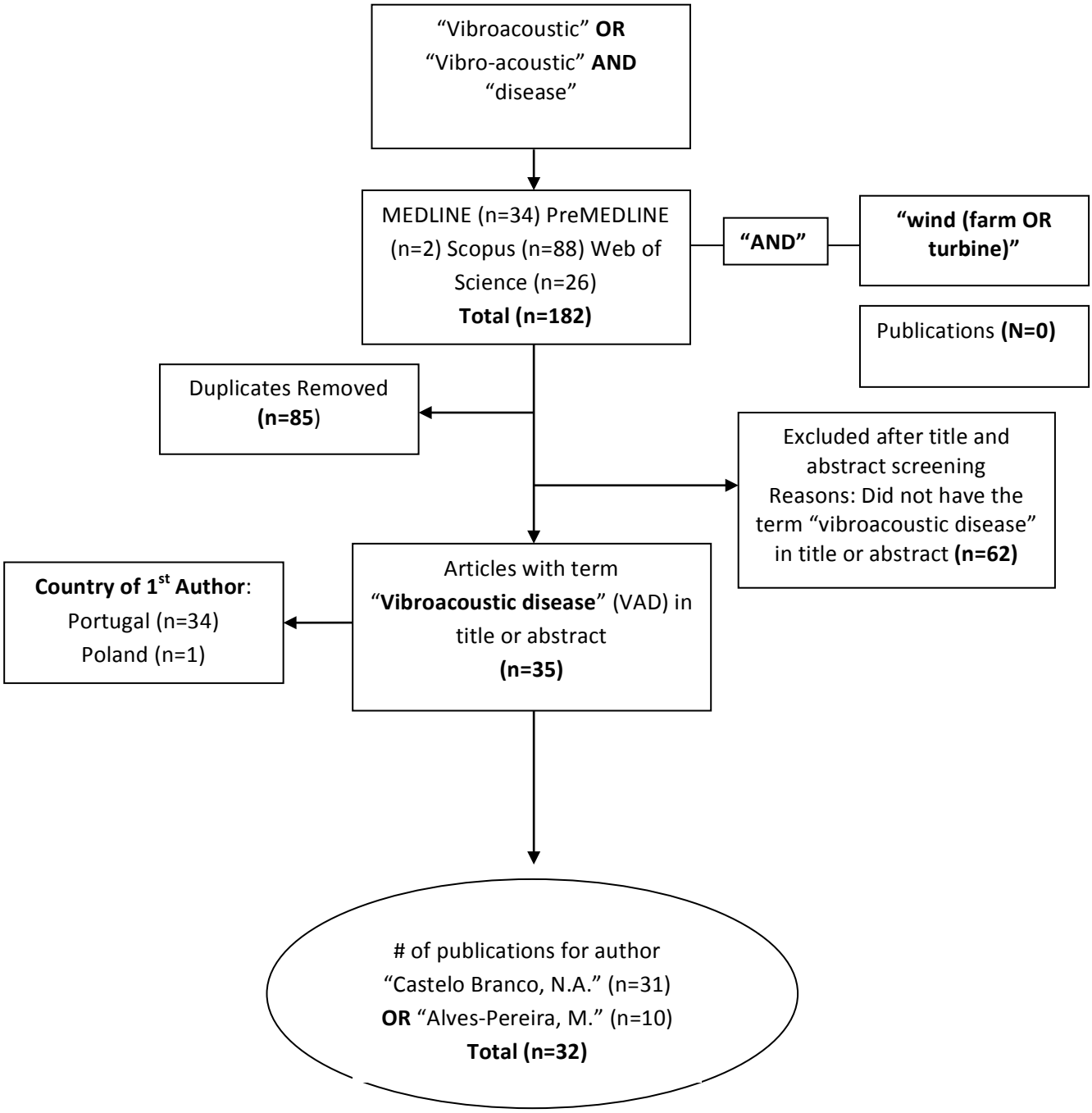

Table 1. Stages of Vibroacoustic Disease

Clinical Stage	Exposure Time	Sign/Symptom
Stage I –Mild	2 years	Slight mood swings, indigestion and heart burn, mouth/throat infections, bronchitis
Stage II- Moderate	2-10 years	Chest pain, definite mood swings, back pain, fatigue, fungal, viral and parasitic skin infections, inflammation of stomach lining, pain and blood in urine, conjunctivitis, allergies
Stage III – Severe	>10 years	Psychiatric disturbances, haemorrhates (sic) of nasal, digestive and conjunctive mucosa, varicose veins and haemorrhoids, duodenal ulcers, spastic colitis, decrease in visual acuity, headaches, severe joint pain, intense muscular pain, neurological disturbances

Table 2. Publications on Vibroacoustic disease by Year with Author Self-Citation Rates

Year	#	Journal	Journal Impact Factor	# Citations	Excluding self-citation	Diachronous Self-citation Rate	Synchronous Self-citation Rate
1999	21	Aviation, Space and Environmental Medicine	0.99	497	121	77%	53%
2000	0		-	-	-	-	-
2001	1	Aviation, Space and Environmental Medicine	0.99	7	1	86%	55%
2002	1	European Journal of Anatomy	-	9	1	89%	42%
2003	1	Revista Portuguesa de Pneumologia	0.36	4	0	100%	41%
2004	2	Noise and Health (1)	0.74	16	9	44%	63%
		European Journal of Lymphology & Related Problems (1)§	-	0	-	-	83%
2005	1	European Journal of Anatomy (1)§	-	3	0	100%	68%
2006	6	Revista Portuguesa de Pneumologia* (5)	0.36	1	1	0%	59%
		Central European Journal of Public Health (1)	2.27	3	1	67%	65%
2007	2	Progress in Biophysics & Molecular Biology (1)	3.96	9	9	0%	70%
		Revista Portuguesa de Pneumologia (1)	0.36	1	1	0%	70%
Total	**35**			**550**	**144**		

§ No journal impact factor available

Table 3. Self-citation rates and H-index for two vibroacoustic researchers

	Alves-Pereira	Castelo Branco
# Articles on Vibroacoustic Disease	17	48
Total # Citations for VAD Articles	116	679
Excluding Self-citation (Author)	74	213
Self-citation rate	36%	69%
Excluding self-citation (any author on original article)	40	186
H- Index	5	9
H-Index (excluding self-citations)	4	8