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Tremor and Other Hyperkinetic Movements

Articles

The Top 100 Cited Articles in Essential Tremor

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Abstract

Background: The impact of scientific articles is proportional to the citations they have received. Our aim was to identify and analyze the top 100 cited articles on essential tremor (ET).

Methods: The Institute for Scientific Information Web of Knowledge Database and the 2012 Journal Citation Report Science Editions were used to retrieve the 100 top-cited articles published about ET from 1960 to April 2013. Information was collected by the Analyze Tool on the Web of Science, including number of citations, publication title, journal name, publication year, and country and institution of origin. Additional analyses were then performed to determine authorship, article type, study design, and level of evidence.

Results: Almost half of the articles were retrieved from two journals: *Neurology* (n=31) and *Movement Disorders* (n=18). The top 100 articles were published between 1960 and 2010, with case series being the most common study design (n=34). According to their countries of origin, more than half of the articles were generated in the United States (n=54), which led the list. Columbia University in the United States produced the largest number of ET articles (n=19), followed by the University of Kansas (n=18). The most frequent first authors of the top-cited articles in ET were E.D. Louis (n=27) and W.C. Koller (n=15), who together accounted for 42% of the articles on the list.

Discussion: It is important to acknowledge the top-cited articles as they mark key topics and advances in ET.

Keywords: Bibliometrics, citation analysis, top-cited, essential tremor

Citation: Benito-León J, Louis ED. The top 100 cited articles in essential tremor. Tremor Other Hyperkinet Mov 2013; 3: http://tremorjournal.org/article/view/186

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Editor: Ruth Walker, Mount Sinai School of Medicine, United States of America

Received: June 8, 2013 **Accepted:** August 2, 2013 **Published:** September 23, 2013

Funding: Dr. Benito-León is supported by the National Institutes of Health, Bethesda, MD, USA (R01 NS039422), and the Commission of the European Union (grant ICT-2011-287739, NeuroTREMOR, principal investigator). Dr. Elan D. Louis has received research support from the National Institute of Neurological Disorders and Stroke, National Institutes of Health, Bethesda, MD, USA (NINDS R01 NS042859, principal investigator; NINDS R01 NS39422, principal investigator; NINDS T32 NS07153-24, principal investigator; NINDS R01 NS073872, principal investigator; NINDS R21 NS077094, co-investigator; and NINDS R01 NS36630, co-investigator) and the Parkinson's Disease Foundation (principal investigator).

Financial disclosures: None.

Conflict of interest: The authors report no conflict of interest.

Introduction

The number of times an article is cited in scientific journals reflects its impact on a specific biomedical field or specialty and reflects the impact of the authors' creativity.[1–3] The Institute for Scientific Information (ISI) has been collecting citation and other academic impact information since 1945, and this information has been electronically available since 1979. ISI (now a subsidiary of Thomson Corp.) has named their newest journal citation system "Science Citation Index Expanded," and it is one of the databases available under the banner of the Web of Science.[4] Citation data from peer-reviewed articles are indexed for more than 10,000 high-impact journals in the sciences and social sciences, as well as in the arts and humanities.

Table 1. The 100 Top-Cited ET Articles

Rank	Article	Number of Citations
1	Benamer HTS, Patterson J, Grosset DG, et al. Accurate differentiation of parkinsonism and essential tremor using visual assessment of [123I]-FP-CIT SPECT imaging: the [123I]-FP-CIT study group. *Mov Disord* 2000;15:503–510.	293
2	Limousin P, Speelman JD, Gielen F, Janssens M. Multicentre European study of thalamic stimulation in parkinsonian and essential tremor. *J Neurol Neurosurg Psychiatry* 1999;66:289–296.	264
3	Louis ED, Ottman R, Allen Hauser W. How common is the most common adult movement disorder? Estimates of the prevalence of essential tremor throughout the world. *Mov Disord* 1998;13:5–10.	203
4	Bain PG, Findley LJ, Thompson PD, et al. A study of hereditary essential tremor. *Brain* 1994;117:805–824.	202
5	Lou JS, Jankovic J. Essential tremor: clinical correlates in 350 patients. Neurology 1991;41:234–238.	164
6	Gulcher JR, Jónsson P, Kong A, et al. Mapping of a familial essential tremor gene, FET1, to chromosome 3q13. *Nat Gen* 1997;17:84–87.	154
7	Jenkins IH, Bain PG, Colebatch JG, et al. A positron emission tomography study of essential tremor: evidence for overactivity of cerebellar connections. *Ann Neurol* 1993;34:82–90.	153
8	Benabid AL, Pollak P, Seigneuret E, Hoffmann D, Gay E, Perret J. Chronic VIM thalamic stimulation in Parkinson's disease, essential tremor and extra-pyramidal dyskinesias. *Acta Neurochir Suppl (Wien)* 1993;58:39–44.	136
9	Ondo W, Jankovic J, Schwartz K, Almaguer M, Simpson RK. Unilateral thalamic deep brain stimulation for refractory essential tremor and Parkinson's disease tremor. *Neurology* 1998;51:1063–1069.	133
10	Louis ED. Essential tremor. *Lancet Neurol* 2005;4:100–110.	132
11	Louis ED, Faust PL, Vonsattel JP, et al. Neuropathological changes in essential tremor: 33 Cases compared with 21 controls. *Brain* 2007;130:3297–3307.	131
12	Rajput AH, Offord, KP, Beard CM, Kurland LT. Essential tremor in Rochester, Minnesota: a 45-year study. *J Neurol Neurosurg Psychiatry* 1984;47:466–470.	130
13	Koller WC, Busenbark K, Miner K, et al. The relationship of essential tremor to other movement disorders: report on 678 patients. *Ann Neurol* 1994;35:717–723.	128
14	Deuschl G, Wenzelburger R, Löffler K, Raethjen J, Stolze H. Essential tremor and cerebellar dysfunction. Clinical and kinematic analysis of intention tremor. *Brain* 2000;123:1568–1580.	127
15	Higgins JJ, Pho LT, Nee LE. A gene (ETM) for essential tremor maps to chromosome 2p22–p25. *Mov Disord* 1997;12:859–864.	126
16	Benito-León J, Bermejo-Pareja F, Morales J-M, Vega S, Molina J-A. Prevalence of essential tremor in three elderly populations of central Spain. *Mov Disord* 2003;18:389–394.	118
17	Dogu, O, Sevim S, Camdeviren H, et al. Prevalence of essential tremor: door-to-door neurologic exams in Mersin Province, Turkey. *Neurology* 2003;61:1804–1806	112
18	Stolze, H, Petersen, G, Raethjen J, Wenzelburger R, Deuschl G. The gait disorder of advanced essential tremor. *Brain* 2002;124:2278–2286.	110
19	Gironell A, Kulisevsky J, Barbanoj M, López-Villegas D, Hernández G, Pascual-Sedano B. A randomized placebo-controlled comparative trial of gabapentin and propranolol in essential tremor. *Arch Neurol* 1999;56:475–480.	110

Table 1. Continued

Rank	Article	Number of Citations
20	Elble, RJ. Physiologic and essential tremor. *Neurology* 1986;36:225–231.	109
21	Zesiewicz TA, Elble RJ, Louis ED, et al. Practice parameter: therapies for essential tremor: report of the quality standards subcommittee of the American Academy of Neurology. *Neurology* 2005;64:2008–2020.	105
22	Asenbaum S, Pirker W, Angelberger P, Bencsits G, Pruckmayer M, Brücke T. [123I]β-CIT and SPECT in essential tremor and Parkinson's disease. *J Neural Transm* 1998;105:1213–1228.	100
23	Bucher SF, Seelos KC, Dodel RC, Reiser M, Oertel WH. Activation mapping in essential tremor with functional magnetic resonance imaging. *Ann Neurol* 1997;41:32–40.	100
24	Wills AJ, Jenkins IH, Thompson PD, Findley LJ, Brooks DJ. Red nuclear and cerebellar but no olivary activation associated with essential tremor: a positron emission tomographic study. *Ann Neurol* 1994;36:636–642.	100
25	Alesch F, Pinter MM, Helscher RJ, Fertl L, Benabid AL, Koos WT. Stimulation of the ventral intermediate thalamic nucleus in tremor dominated Parkinson's disease and essential tremor. *Acta Neurochir (Wien)* 1995;136:75–81.	99
26	Deuschl G, Elble RJ. The pathophysiology of essential tremor. *Neurology* 2000;54(11 SUPPL. 4):S14–S20.	98
27	Cohen O, Pullman S, Jurewicz E, Watner D, Louis ED. Rest tremor in patients with essential tremor: prevalence, clinical correlates, and electrophysiologic characteristics. *Arch Neurol* 2003;60:405–410.	97
28	Bain P, Brin M, Deuschl G, et al. Criteria for the diagnosis of essential tremor. *Neurology* 2000;54(11 SUPPL. 4):S7	97
29	Laesson T, Sjogren T. Essential tremor: a clinical and genetic population study. *Acta Psychiatr Scand Suppl* 1960;36:1–176.	96
30	Louis ED, Marder K, Cote L, et al. Differences in the prevalence of essential tremor among elderly African Americans, whites, and Hispanics in Northern Manhattan, NY. *Arch Neurol* 1995;52:1201–1205.	95
31	Koller WC, Lyons KE, Wilkinson SB, Troster AI, Pahwa R. Long-term safety and efficacy of unilateral deep brain stimulation of the thalamus in essential tremor. *Mov Disord* 2001;16:464–468.	94
32	Elble RJ. Diagnostic criteria for essential tremor and differential diagnosis. Neurology 2000;54(11 SUPPL. 4):S2–S6.	94
33	Rautakorpi I, Takala J, Marttila RJ, Sievers K, Rinne UK. Essential tremor in a Finnish population. *Acta Neurologica Scand* 1982;66:58–67.	91
34	Louis ED, Ottman R, Ford B, et al. The Washington Heights-Inwood Genetic Study of Essential tremor: methodologic issues in Essential-tremor research. *Neuroepidemiology* 1997;16:124–133.	88
35	Colebatch JG, Findley LJ, Frackowiak RSJ, Marsden CD, Brooks DJ. Preliminary report: activation of the cerebellum in essential tremor. *Lancet* 1990;336:1028–1030.	88
36	Hariz MI, Shamsgovara P, Johansson F, Hariz G-M, Fodstad H. Tolerance and tremor rebound following long-term chronic thalamic stimulation for Parkinsonian and essential tremor. *Stereotact Funct Neurosurg* 1999;72:208–218.	86
37	Singer C, Sanchez-Ramos J, Weiner WJ. Gait abnormality in essential tremor. *Mov Disord* 1994;9:193–196.	86
38	Benito-León J, Louis ED. Essential tremor: emerging views of a common disorder. *Nat Clin Pract Neurol* 2006;2:666–678.	85

Table 1. Continued

Rank	Article	Number of Citations
39	Louis ED, Zheng W, Jurewicz EC, et al. Elevation of blood *B*-carboline alkaloids in essential tremor. *Neurology* 2002;59:1940–1944.	85
40	Louis ED, Ottman R. How familial is familial tremor? The genetic epidemiology of essential tremor. *Neurology* 1996;46:1200–1205	85
41	Lombardi WJ, Woolston DJ, Roberts JW, Gross RE. Cognitive deficits in patients with essential tremor. *Neurology* 2001;57:785–790.	84
42	Louis ED, Shungu DC, Chan S, Mao X, Jurewicz EC, Watner D. Metabolic abnormality in the cerebellum in patients with essential tremor: a proton magnetic resonance spectroscopic imaging study. *Neurosci Lett* 2002;333:17–20.	83
43	Louis ED, Barnes L, Albert SM, et al. Correlates of functional disability in essential tremor. *Mov Disord* 2001;16:914–920.	83
44	Leehey MA, Munhoz RP, Lang AE, et al. The fragile X premutation presenting as essential tremor. *Arch Neurol* 2003;60:117–121.	82
45	Boecker H, Wills AJ, Ceballos-Baumann A, et al. The effect of ethanol on alcohol-responsive essential tremor: a position emission tomography study. *Ann Neurol* 1996;39:650–658.	81
46	Benito-León J, Louis ED, Bermejo-Pareja F. Population-based case-control study of cognitive function in essential tremor *Neurology* 2006;66:69–74.	80
47	Pahwa R, Lyons K, Hubble JP, et al. Double-blind controlled trial of gabapentin in essential tremor. *Mov Disord* 1998;13:465–467.	80
48	Raethjen J, Lindemann M, Schmaljohann H, Wenzelburger R, Pfister G, Deuschl G. Multiple oscillators are causing parkinsonian and essential tremor. *Mov Disord* 2000;15:84–94.	79
49	Busenbark KL, Nash J, Nash S, Hubble JP, Koller WC. Is essential tremor benign? *Neurology* 1991;41:1982–1983.	79
50	Jankovic J. Essential tremor: a heterogeneous disorder. *Mov Disord* 2002;17:638–644.	78
51	Rajput, A, Robinson CA, Rajput AH. Essential tremor course and disability: a clinicopathologic study of 20 cases. *Neurology* 2004;62:932–936.	77
52	Louis ED, Ford B, Frucht S, Barnes LF, X-Tang M, Ottman R. Risk of tremor and impairment from tremor in relatives of patients with essential tremor: a community-based family study. *Ann Neurol* 2001;49:761–769.	77
53	Hellwig B, Häussler S, Schelter B, et al. Tremor-correlated cortical activity in essential tremor. *Lancet* 2001;357:519–523.	77
54	Hallett M, Dubinsky RM. Glucose metabolism in the brain of patients with essential tremor. *J Neurol Sci* 1993;114:45–48.	76
55	Benito-León J, Bermejo-Pareja, F, Louis ED. Incidence of essential tremor in three elderly populations of Central Spain. *Neurology* 2005;64:1721–1725.	75
56	Connor GS. A double-blind placebo-controlled trial of topiramate treatment for essential tremor. *Neurology* 2002;59:132–134.	75

Table 1. Continued

Rank	Article	Number of Citations
57	Hubble JP, Busenbark KL, Wilkinson S, Penn RD, Lyons K, Koller WC. Deep brain stimulation for essential tremor. *Neurology* 1996;46:1150–1153.	75
58	Sydow O, Thobois S, Alesch F, Speelman JD. Multicentre European study of thalamic stimulation in essential tremor: a six year follow up. *J Neurol Neurosurg Psychiatry* 2003;74:1387–1391.	74
59	Helmchen C, Hagenow A, Miesner J, et al. Eye movement abnormalities in essential tremor may indicate cerebellar dysfunction. *Brain* 2003;126:1319–1332.	74
60	Ondo W, Hunter C, Vuong KD, Schwartz K, Jankovic J. Gabapentin for essential tremor: a multiple-dose, double-blind, placebo-controlled trial. *Mov Disord* 2000;15:678–682.	73
61	Jankovic, J. Essential tremor: clinical characteristics. *Neurology* 2000;54(11 SUPPL. 4):S21–S25.	73
62	Dupuis MJM, Delwaide PJ, Boucquey D, Gonsette RE. Homolateral disappearance of essential tremor after cerebellar stroke. *Mov Disord* 1989;4:183–187.	73
63	Louis ED, Ford B, Lee H, Andrews H. Does a screening questionnaire for essential tremor agree with the physician's examination? *Neurology* 1998;50:1351–1357.	72
64	Salemi G, Savettieri G, Rocca WA, et al. Prevalence of essential tremor: a door-to-door survey in Terrasini, Sicily. *Neurology* 1994;44:61–64.	72
65	Shahed J, Jankovic J. Exploring the relationship between essential tremor and Parkinson's disease. *Parkinsonism Relat Disord* 2007;13:67–76.	71
66	Louis ED, Vonsattel JPG, Honig LS, Ross GW, Lyons KE, Pahwa R. Neuropathologic findings in essential tremor. *Neurology* 206;66:1756–1759.	71
67	Deng H, Le W, Jankovic J. Genetics of essential tremor. *Brain* 2007;130:1456–1464.	70
68	Higgins JJ, Loveless JM, Jankovic J, Patel PI. Evidence that a gene for essential tremor maps to chromosome 2p in four families. *Mov Disord* 1998;13:972–977.	70
69	Benito-León J, Louis ED, Bermejo-Pareja F. Elderly-onset essential tremor is associated with dementia. *Neurology* 2006;66:1500–1505.	69
70	Jeanneteau F, Funalot B, Jankovic J, et al. A functional variant of the dopamine D3 receptor is associated with risk and age-at-onset of essential tremor. *Proc Natl Acad Sci U S A* 2006;103:10753–10758.	68
71	Hubble JP, Busenbark KL, Pahwa R, Lyons K, Koller WC. Clinical expression of essential tremor: effects of gender and age. *Mov Disord* 1997;12:969–972.	68
72	Rajput AH, Rozdilsky B, Ang L, Rajput A. Clinicopathologic observations in essential tremor: report of six cases. *Neurology* 1991;41:1422–1424.	68
73	Louis ED. Essential tremor. *N Engl J Med* 2001;345:887–891.	67
74	Koller WC, Vetere-Overfield B. Acute and chronic effects of propranolol and primidone in essential tremor. *Neurology* 1989;39:1587–1588.	67
75	Geraghty JJ, Jankovic J, Zetusky WJ. Association between essential tremor and Parkinson's disease. *Ann Neurol* 1985;17:329–333.	67
76	Hornabrook RW, Nagurney JT. Essential tremor in Papua New Guinea. *Brain* 1976;99:659–672.	67

Table 1. Continued

Rank	Article	Number of Citations
77	Pahwa R, Lyons KL, Wilkinson SB, et al. Bilateral thalamic stimulation for the treatment of essential tremor. *Neurology* 1999;53:1447–1450.	66
78	Louis ED, Ford B, Lee H, Andrews H, Cameron G. Diagnostic criteria for essential tremor: a population perspective. *Arch Neurol* 1998;55:823–828.	66
79	Kralic JE, Criswell HE, Osterman JL, et al. Genetic essential tremor in γ-aminobutyric acidA receptor α1 subunit knockout mice. *J Clin Invest* 2005;115:774–779.	65
80	Tanner CM, Goldman SM, Lyons KE, et al. Essential tremor in twins: an assessment of genetic vs environmental determinants of etiology. *Neurology* 2001;57:1389–1391.	65
81	Findley LJ, Koller WC. Essential tremor: a review. *Neurology* 1987;37:1194–1197.	65
82	Bermejo-Pareja F, Louis ED, Benito-León J. Risk of incident dementia in essential tremor: a population-based study. *Mov Disord* 2007;22:1573–1580.	64
83	Tröster AI, Woods SP, Fields JA, et al. Neuropsychological deficits in essential tremor: an expression of cerebello-thalamo-cortical pathophysiology? *Eur J Neurol* 2002;9:143–151.	64
84	Pahwa R, Lyons KE, Wilkinson SB, et al. Comparison of thalamotomy to deep brain stimulation of the thalamus in essential tremor. *Mov Disord* 2001;16:140–143.	64
85	Hua SE, Lenz FA, Zirh TA, Reich SG, Dougherty PM. Thalamic neuronal activity correlated with essential tremor. *J Neurol Neurosurg Psychiatry* 1998;64:273–276.	64
86	Louis ED, Honig LS, Vonsattel JPG, Maraganore DM, Borden S, Moskowitz CB. Essential tremor associated with focal nonnigral Lewy bodies: a clinicopathologic study. *Arch Neurol* 2005;62:1004–1007.	63
87	Koller WC, Royse VL. Efficacy of primidone in essential tremor. *Neurology* 1986;36:121–124.	62
88	Louis ED, Ferreira JJ. How common is the most common adult movement disorder? Update on the worldwide prevalence of essential tremor. *Mov Disord* 2010;25:534–541.	61
89	Louis ED, Vonsattel JPG. The emerging neuropathology of essential tremor. *Mov Disord* 2008;23:174–182.	61
90	Findley LJ, Cleeves L, Calzetti S. Primidone in essential tremor of the hands and head: a double blind controlled clinical study. *J Neurol Neurosurg Psychiatry* 1985;48:911–915.	61
91	Axelrad JE, Louis ED, Honig LS, et al. Reduced Purkinje cell number in essential tremor: a postmortem study. *Arch Neurol 2008*;65:101–107.	59
92	Ondo WG, Jankovic J, Connor GS, et al. Topiramate in essential tremor: a double-blind, placebo-controlled trial *Neurology* 2006;66:672–677.	59
93	Gasparini M, Bonifati V, Fabrizio E, et al. Frontal lobe dysfunction in essential tremor: a preliminary study. *J Neurol* 2001;248:399–402.	59
94	Benito-León J, Louis ED, Bermejo-Pareja F. Risk of incident Parkinson's disease and parkinsonism in essential tremor: a population based study. *J Neurol Neurosurg Psychiatry* 2009;80:423–425.	58
95	Findley LJ. Epidemiology and genetics of essential tremor. *Neurology* 2000;54:S8–S13.	58
96	Halliday DM, Conway BA, Farmer SF, Shahani U, Russell AJC, Rosenberg JR. Coherence between low-frequency activation of the motor cortex and tremor in patients with essential tremor. *Lancet* 2000;355:1149–1153.	58

Table 1. Continued

Rank	Article	Number of Citations
97	Shill HA, Adler CH, Sabbagh MN, et al. Pathologic findings in prospectively ascertained essential tremor subjects. *Neurology* 2008;70:1452–1455.	57
98	Rajput AH, Rozdilsky B, Ang L, Rajput A. Significance of Parkinsonian manifestations in essential tremor. *Can J Neurol Sci* 1993;20:114–117.	57
99	Goldman MS, Ahlskog JE, Kelly PJ. The symptomatic and functional outcome of stereotactic thalamotomy for medically intractable essential tremor. *J Neurosurg* 1992;76:924–928.	57
100	Stefansson H, Steinberg S, Petursson H, et al. Variant in the sequence of the LINGO1 gene confers risk of essential tremor. *Nat Genet* 2009;41:277–279.	56

In recent years, several citation analyses of the top-cited articles have become available for various areas of clinical neurology and neurosurgery, including epilepsy,[5] multiple sclerosis,[6] Parkinson's disease,[7] brain metastases research,[8] and neurosurgery.[9–11] However, no similar study has been performed in the field of essential tremor (ET). ET is one of the most common involuntary movement disorders, and it is the most common tremor disorder.[12–14] The past few years have witnessed an exponential growth in the number of scientific publications on ET, mainly across the disciplines of epidemiology, clinical features, and pathology.[15–18]

We used the electronic version of the Science Citation Index Expanded to determine which published articles in ET have been cited most often by ranking the 100 top-cited works. The expectation was to provide references for future studies and clinical practices.

Methods

A search was performed using the bibliometric database ISI Web of Science for articles including the keyword "Essential tremor*" in the title (the asterisk was included in the search string as a wild card character). In early April 2013, we identified the 100 top-cited articles (Table 1) published in professional journals since 1960 by the Web of Science. All articles in each given journal were ranked by the number of citations listed on Web of Science. The full texts were mainly selected by PubMed and ScienceDirect.

Basic information concerning country of origin (based on the first author), institution, year of publication, publication name, and citations of the target articles were collected from Web of Science using the analyze tool. Additional analyses were then performed to determine authorship, article type, study design, and level of evidence. For each study, the level of evidence was graded according to Hadorn et al.[19]

Cited half-life is defined as the number of publication years from the current year, which account for 50% of current citations received.[4] This index helps to evaluate the age of the majority of cited articles published in a journal.[4] The h-index aims to measure the cumulative impact of a researcher's output; the value of h is equal to the number of papers (n) that have n or more citations.[20]

Results

Journals and publication dates of the top-cited articles on ET

The 100 top-cited articles (Table 1) were published in 26 journals. Journal title, impact factor, number of articles, and cited half-life are listed in Table 2. Almost half of the articles were retrieved from two journals: *Neurology* (n=31) and *Movement Disorders* (n=18). The 100 top-cited articles on ET were published from 1960 to 2010 (Figure 1). The greatest number of top-cited articles (n=10) were published in 2000, and eight of the top 10-cited articles were published in the 1990s (Table 1) (Figure 1).[18,21–29] Ninety-one of the articles were published within the past 25 years (Figure 1).

Sixty-two authors contributed two or more articles to the list, and five contributed 10 or more (Table 3). The number of authors per article ranged from one to 30, with the most common figures being five (16 articles), three (15 articles), two (12 articles), and seven (12 articles). The most frequent first authors of the top-cited articles in ET were Elan D. Louis (n=27) and William C. Koller (n=15); when combined, they accounted for 42% of the articles on the list (Table 3).

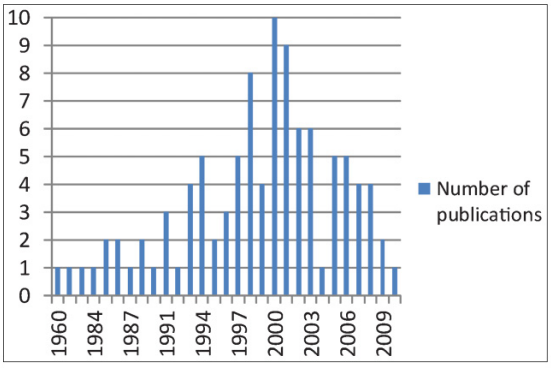

Figure 1. Publication Years for the 100 Top-Cited ET Articles.

Table 2. Journals that Published the 100 Top-Cited ET Articles

		Impact Factor			
Rank	Journal	2011	5-Year Impact Factor	Number of Articles	Cited Half-Life
1	*Neurology*	8.312	7.634	31	8.7
2	*Movement Disorders*	4.505	4.449	18	5.3
3	*Annals of Neurology*	11.089	10.644	7	9.0
4	*Brain*	9.457	10.545	7	7.8
5	*Archives of Neurology*	7.584	6.928	7	8.9
6	*Journal of Neurology Neurosurgery and Psychiatry*	4.764	4.953	6	>10.0
7	*Lancet*	38.278	33.797	3	8.9
8	*Nature Genetics*	35.532	33.096	2	6.8
9	*Acta Neurochirurgica*	1.520	1.839	2	9.8
10	*New England Journal of Medicine*	53.298	50.075	1	7.8
11	*Lancet Neurology*	23.462	20.598	1	3.8
12	*Journal of Clinical Investigation*	13.069	15.430	1	9.4
13	*Proceedings of the National Academy of Sciences of the United States of America*	9.681	10.472	1	7.8
14	*Nature Clinical Practice Neurology*	7.636	6.712	1	4.4
15	*Acta Psychiatrica Scandinavica*	4.220	4.299	1	>10.0
16	*Parkinsonism & Related Disorders*	3.795	3.173	1	3.9
17	*European Journal of Neurology*	3.692	3.239	1	4.5
18	*Journal of Neurology*	3.473	3.203	1	6.5
19	*Journal of Neurosurgery*	2.965	3.088	1	>10.0
20	*Journal of Neural Transmission*	2.730	2.662	1	6.1
21	*Acta Neurologica Scandinavica*	2.469	2.347	1	9.8
22	*Journal Neurological Sciences*	2.353	2.441	1	8.7
23	*Neuroepidemiology*	2.305	2.817	1	6.3
24	*Neuroscience Letters*	2.105	2.168	1	8.3
25	*Stereotactic and Functional Neurosurgery*	1.849	1.913	1	9.4
26	*Canadian Journal of Neurological Sciences*	0.968	1.177	1	112

According to their countries of origin (based on the first author), more than half of the articles were generated in the United States (n=54), which led the list (Table 4). The United Kingdom (n=11) was the second-most productive country, followed by Spain (n=8), Germany (n=7), and Canada (n=4). France and Sweden each contributed three articles to the list. The 13 leading institutions that provided two or more top-cited ET articles are listed in Table 5. Columbia University in the United States produced the largest number of top-cited ET articles (n=19), followed by the University of Kansas (n=18), and Baylor College of Medicine

Table 3. Authors with Two or More Top-Cited ET Articles

Rank	Author	Number of Citation Classics	Number of Articles		h-index
			As First Author	As Co-Author	
1	Louis ED	27	17	10	48
2	Koller WC	15	4	11	58
3	Jankovic J	12	2	10	83
4	Pahwa R	11	3	8	46
5	Lyons K	11	0	11	21
6	Findley LJ	9	3	6	36
7	Rajput AH	8	5	4	40
8	Rajput A	8	2	6	37
9	Benito-León J	7	6	1	29
10	Elble R	6	2	4	19
11	Deuschl G	6	2	4	56
12	Bermejo-Pareja F	6	1	5	20
13	Busenbark K	5	1	4	16
14	Ford B	5	0	5	35
15	Vonsattel JP	5	0	5	34
16	Ondo W	4	3	1	20
17	Tröster AI	4	1	3	37
18	Honig LS	4	0	4	28
19	Wilkinson S	4	0	4	17
20	Wenzelburger R	4	0	4	16
21	Thompson PD	4	0	4	54
22	Ottman R	4	0	4	41
23	Hubble JP	4	0	4	27
24	Brooks DJ	4	0	4	87
25	Bain PG	3	2	1	25
26	Raethjen J	3	1	2	17
27	Speelman JD	3	0	3	32
28	Ross GW	3	0	3	39
29	Pullman S	3	0	3	12
30	Marsden CD	3	0	3	126
31	Jurewicz EC	3	0	3	10

Table 3. Continued

Rank	Author	Number of Citation Classics	Number of Articles		h-index
			As First Author	As Co-Author	
32	Hariz MI	2	2	0	31
33	Connor GS	2	1	1	3
34	Colebatch JG	2	1	1	38
35	Benabid AL	2	1	1	60
36	Stolze H	2	1	1	19
37	Deng H	2	1	1	22
38	Wills AJ	2	1	1	15
39	Alesch F	2	1	1	18
40	Hauser W	2	0	2	23
41	Weiner WJ	2	0	2	45
42	Tang MX	2	0	2	50
43	Stefansson K	2	0	2	24
44	Schwartz K	2	0	2	19
45	Rozdilsky B	2	0	2	29
46	Robinson CA	2	0	2	8
47	Overman J	2	0	2	10
48	Oertel WH	2	0	2	55
49	Nash J	2	0	2	14
50	Moskowitz CB	2	0	2	14
51	Lee H	2	0	2	31
52	Kong A	2	0	2	6
53	Jenkins IH	2	0	2	16
54	Jakobsson F	2	0	2	6
55	Higgins JJ	2	0	2	18
56	Benedickz J	2	0	2	1
57	Frackowiak RSJ	2	0	2	76
58	Faust PL	2	0	2	12
59	Cote L	2	0	2	33
60	Borden S	2	0	2	4
61	Barnes LF	2	0	2	7
62	Andrews H	2	0	2	26

Table 4. Country of Origin of the 100 Top-Cited ET Articles

Rank	Country of Origin	Number of Articles
1	USA	54
2	United Kingdom	11
3	Spain	8
4	Germany	7
5	Canada	4
6	France	3
7	Sweden	3
8	Austria	2
9	Italy	2
10	Iceland	2
11	Finland	1
12	Belgium	1
13	Turkey	1
14	Papua New Guinea	1

(n=9), both in the United States, and Móstoles University Hospital in Spain (n=6).

Among the 100 top-cited ET articles, a large number had a case-series design (n=34), and the next most common design was the case-control study (n=24) (Table 6). Only six articles were clinical trials (Table 6). According to the study designs, the level of evidence of articles is presented in Table 7. Most articles were classified as level B evidence.

We also performed an analysis in which we excluded any examples of self-citations (i.e., instances in which authors cited their own work), and the results of this analysis did not change the main findings of the study (e.g., country of origin, institution of origin, top cited authors, etc.).

Discussion

In medical literature, the study of the number of times authors reference an article is one measure of the influence of the publication, and this type of citation analysis is widespread.[1–3] The evaluation of specialty-wide citation analysis has been reported in other areas of the neurosciences.[5–11] By ranking the 100 most-cited works, we aimed to determine which published journal articles on ET have exerted the most citation influence. The top article was cited 293 times. This figure is far lower than that found in Parkinson's disease, in which the top-cited article garnered 4,327 citations.[7]

Table 5. Institution of Origin of Authors with Two or More Top-Cited ET Articles

Rank	Country of Origin	Number of Articles
1	Columbia University, New York, New York, USA	19
2	University of Kansas Medical Center, Kansas City, Kansas, USA	18
3	Baylor College of Medicine, Houston, Texas, USA	9
4	Móstoles University Hospital, Móstoles, Madrid, Spain	6
5	University of Saskatchewan, Saskatoon, Saskatchewan, Canada	5
6	Hammersmith Hospital, London, United Kingdom	4
7	Christian-Albrechts-University of Kiel, Kiel, Germany	4
8	Oldchurch Hospital, Romford, United Kingdom	3
9	Institute of Neurology, London, United Kingdom	2
10	deCODE Genetics, Reykjavik, Iceland	2
11	Southern Illinois University School of Medicine, Springfield, Illinois, USA	2
12	University of Vienna, Austria	2
13	National Institute of Neurological Disorders and Stroke, National Institutes of Health, Bethesda, Maryland, USA	2

Table 6. Study Design of the Clinical Studies

Study Design	Number of Articles
Experimental study	
Randomized, controlled trial, open-label trial	6
Observational study	
Cohort study	4
Case-control study	24
Descriptive study	
Cross-sectional study	10
Case series	34
Case report	2
Methods paper	1
Review articles or expert opinion	18
Animal research	1

In 2002, Callaham et al.[30] found that the impact factor of the original publishing journal, rather than the methodology or quality of the research, was an effective predictor of the number of times an article would be cited per year. However, as shown in the present study (Table 2), the actual citation value of the individual article did not positively relate to the impact factor of the journal.

In general, as shown in Table 3, the 100 top-cited articles in ET were articles that have been available for 10 or more years, and only one target article was published more recently (in 2010). It has been reported that scientific articles begin to be cited 1 or 2 years after publication, and reach a maximum citation rate 7 to 10 years after publication.[31] However, an interval of 10 to 20 years is needed for maximal recognition of prominent articles in a field.[32,33] This may explain why recently published articles were cited rarely, and few appeared on the list.

Among the 100 top-cited articles on ET, the most common design was the case series design (n=34), followed by the case-control study (n=24) (Table 6), implying that descriptive and observational studies are most frequent for ET. This suggests the relative ease of carrying out simpler study designs in ET. It is known that different study designs could correspond to different levels of evidence. In the hierarchy of research study designs, systematic reviews, meta-analyses, and well-conducted randomized clinical trials (RCTs) provide the highest quality of evidence for most clinical or interventional questions, and the lowest grade is applied to expert opinions. Among the 100 target articles, there were only six RCTs. Moreover, only one RCT was found among the top 20 medical articles. This is a common finding among the different studies that have analyzed the 100 most-cited papers in different disciplines.[7,31,34–36] There are several possible explanations for the low numbers of RCTs. First, RCTs are expensive and time consuming. Second, it is difficult to gather large sample and control groups. Third, it may be that RCTs were published relatively recently, so they had not yet reached a significant number of citations.

Compared to Parkinson's disease, there are very few articles addressing more basic science issues in ET (e.g., laboratory studies including gene discovery, molecular biology, and cellular biology; neuroimaging studies; neuropathological studies; and animal model studies).[7] Scientific understanding of ET is in its infancy.

This study had a number of potential limitations. First and foremost, this survey was restricted to journal articles with the term "essential tremor" in the title. In other words, some significant ET articles could have been excluded, and it is possible that these were high-quality articles with a large number of citations. Second, this type of citation analysis does not include citations in textbooks and lectures, and an author's or authors' potential preference to cite articles in the journal in which they seek to publish their work.[37] Third, there is a clear time effect in citation analysis, with the most recent articles being at a disadvantage.[30] The time from publication played an apparent role here, with late 1990s and early 2000s being the most prominent years of publication for the 100 most-cited articles. Recent articles are clearly disadvantaged in citation analysis. Fourth, the language of publication plays a major role, with an obvious bias for articles published in

Table 7. Level of Evidence of the Clinical Studies

Levels of Evidence	Number of Articles
Level A: Well-conducted RCT with 100 patients or more (including multi-center and meta-analyses); well-conducted RCT with fewer than 100 patients (one or more institutions and meta-analysis; well-conducted study)	1
Level B: Well-conducted case-control study, poorly controlled or uncontrolled (including RCT with one or more major or three or more minor methodological flaws), observations studies with high potential for bias (case series with comparison to historical controls), case series or case reports, conflicting evidence with more support	79
Level C: Expert opinion	18

English-language journals. Fifth, there are biases inherent in the age of the database, as any articles published in the 19th or early 20th century would be excluded, which likely causes some true "classic" articles to be excluded. Finally, Kuhnian philosophy[38] would tell us that in a scientific community there is a tendency for adherence to a paradigm. In this context, there is "snowball effect" for citations, as other authors are more likely to cite an article because of previous citations to that article rather than its content or quality.

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