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My Thoughts/My Surgical Practice

The top 100 most disruptive publications in academic surgery journals: 1954–2014

The use of bibliometrics to analyze academic productivity has gained increasing attention in the surgical community.[1,2] Citation count is the most used publication-level metric that measures academic achievement and impact of individual publications in a scientific field,[3,4] but its utility has been undermined by numerous criticisms.[5–7]

In response, researchers have developed novel metrics to capture distinct academic achievements. One such paper-level metric recently validated to identify paradigm shifting papers is the disruption score, which measures the degree to which a paper disrupts its field by "introducing something new that eclipses attention to previous work upon which it has built."[8,9] A disruptive paper is one that is cited more often than its own references after publication.

The disruption score, a ratio of two numbers, varies between −1 and +1.[8] The numerator is the number of future papers that cited the focal paper without also citing any of its references minus the number of future papers that cited the focal paper and at least one of its references. The denominator is the total number of times the focal paper was cited plus the number of future papers that cited at least one of the references of the focal paper, but not the focal paper itself.

Positive scores correspond to publications that *disrupt* science with those closer to +1 being the most disruptive. Identifying the most disruptive surgical papers may shed light on changes in paradigms over time as well as facilitate scientific discovery in surgery. We aimed to benchmark the disruption score portfolio of academic surgery using a validated dataset of all PubMed papers published between 1954 and 2014.

Fig. 1 is a density plot of the disruption scores for all 12, 742, 382 PubMed publications in 1954–2014. We identified 70,602 papers in *Annals of Surgery* (n = 13,344), *JAMA Surgery* (n = 13,201), *American Journal of Surgery* (n = 15,415), *Journal of the American College of Surgeons* (n = 4163), *Surgery* (n = 14,826) and *Journal of Surgical Research* (n = 9653). Table 1 reports the 100 most disruptive articles. *American Journal of Surgery* had the most papers with 33 followed by *Annals of Surgery* with 29 and *JAMA Surgery* with 22. The top 100 most disruptive publications in surgery were more disruptive than 99.9% of all PubMed papers.

Citation counts ranged from 1 to 582. The correlation coefficient between disruption scores and citation counts was 0.06. This weak correlation suggests that the disruption score is capturing unique aspects of scientific impact that may be overlooked by citation count. With respect to article topics, malignancy was the most represented (n = 12). Other topics included trauma surgery (n = 11), vascular surgery (n = 10), general surgery (n = 10), and education (n = 7).

The most disruptive paper, "Treatment of Carcinoma of the Esophagus: Retrospective study of 2400 patients," was published by Giuli and Gignoux in 1980 in *Annals of Surgery*. It is a retrospective study of esophageal cancer patients and was the largest analysis of long-term survival and prognostic factors at the time. The most disruptive paper in *JAMA Surgery* (#4 overall) was published in 1992 by Webster et al. and reported temporal patterns in gunshot wound admission rates and wound profiles at a level I trauma center. The most disruptive paper in *American Journal of Surgery* (#6 overall) was published in 1974 by Spiro et al. and is a large single-institution analysis of the prognostic significance of nodal staging in cancer of the mouth.

In reviewing the full list of 100 most disruptive articles, it is inspiring to see influential papers that have changed practice and introduced innovative concepts with lasting legacies. For example, the 2nd most disruptive paper ("Patterns of atherosclerosis and their surgical significance") published by the legendary vascular surgeon Michael DeBakey, developed a new framework in vascular surgery with its five-category system of atherosclerotic progression. The 30th most disruptive paper ("Treatment of Large Human Burns With 0.5% Silver Nitrate Solution") published by Carl Moyer was the first case series using 0.5% silver nitrate as a topical antimicrobial for large burn wounds. The 83rd most disruptive paper, "The tension-free hernioplasty," published by Irving Lichtenstein presented a new method for inguinal hernia repair that used polypropylene prosthetic mesh repair to strengthen the fascia transversalis and remains popular. These papers have been frequently cited, but they also share a unique feature that is not true of other papers with multiple citations. They have displaced former ways of thinking and/or established new treatments suggesting that they disrupted the paradigm at the time of publication. While many of the articles identified had high citation counts, several articles did not. 23 had less than 10 citations. This suggests that disruption may also be capturing research from very narrow fields of study with smaller research communities.

It is important to point out the diversity of study designs that we identified. Retrospective cohort studies were the most common type, while phase III randomized controlled trials (RCTS) were not included at all. This suggests that while retrospective studies can have biases not present in RCTs, they still can have lasting clinical influence. Another explanation could be that disruptive RCTs in surgery are published in other medical journals. Case reports/case series reviewing an affliction or presenting a new technique were also

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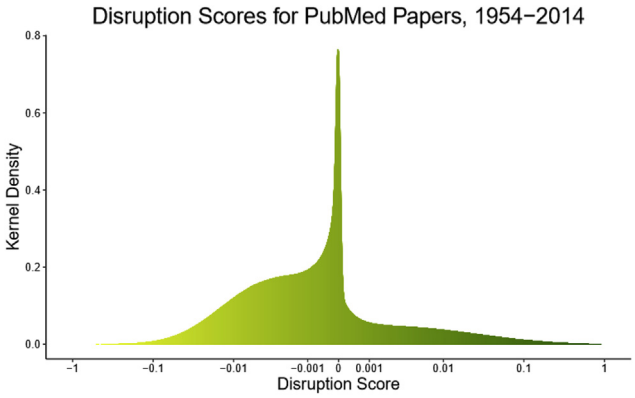

Fig. 1. Kernel density plot of disruption scores for all Pubmed papers published between 1954 and 2014. Negative values indicate developmental papers. Positive values indicate disruptive papers.

common. This may not be surprising since new surgical approaches can change paradigms and established treatments.

In summary, we reviewed six surgery journals and identified the 100 most disruptive papers published between 1954 and 2014 using a new bibliometric index. This editorial provides an understanding of the rich history of academic surgery and highlights seminal research that has changed perspectives and ways of thinking in surgery. These landmark studies provide a benchmark for understanding how surgeon scientists can have a lasting impact within their surgical research domain. We hope that surgeons will find unique insights and interpretations associated with this review which may influence their own paths to scientific discovery.

Table 1
The top 100 most disruptive papers.

Rank	Title	Journal	Year	Disruption Score	Citation Count
1	Treatment of carcinoma of the esophagus. Retrospective study of 2400 patients.	Annals of Surgery	1980	0.829457	74
2	Patterns of atherosclerosis and their surgical significance.	Annals of Surgery	1985	0.804545	175
3	Extended treatment of severe coronary artery disease: a total surgical approach.	Annals of Surgery	1969	0.788945	95
4	Epidemiologic changes in gunshot wounds in Washington, DC, 1983–1990.	JAMA Surgery	1992	0.788462	27
5	Unrecognized abdominal trauma in patients with head injuries.	Annals of Surgery	1965	0.786667	40
6	Cervical node metastasis from epidermoid carcinoma of the oral cavity and oropharynx. A critical assessment of current staging.	American Journal of Surgery	1974	0.78125	138
7	Extremity fractures of patients with spinal cord injuries.	American Journal of Surgery	1962	0.76087	94
8	Epidemiology of major trauma and trauma deaths in Los Angeles County.	Journal of the American College of Surgeons	1998	0.75641	59
9	Effect of laser rays on wound healing.	American Journal of Surgery	1971	0.750929	249
10	Contributions of Thomas Jefferson to American medicine.	American Journal of Surgery	1979	0.75	5
11	The physician, the manufacturer, and medical devices.	JAMA Surgery	1975	0.75	2
12	Mitral replacement: clinical experience with a ball-valve prosthesis.	Annals of Surgery	1961	0.74606	313
13	Double-belical reservoir heart-lung machine designed for hypothermic perfusion; primed with 5% glucose	JAMA Surgery	1961	0.744444	29
14	The release of vasoactive substances in acute pancreatitis.	American Journal of Surgery	1963	0.732558	57
15	The ambulatory surgical unit.	Annals of Surgery	1972	0.730769	12
16	The next generation of surgical residencies. What are the challenges and the opportunities?	JAMA Surgery	1990	0.72973	21
17	Incorporation of endovascular training into a vascular fellowship program.	American Journal of Surgery	1995	0.727273	19
18	Pancreatic pseudocysts: cause, therapy, and results.	American Journal of Surgery	2006	0.715328	61
19	Metastatic melanoma of the gastrointestinal tract.	JAMA Surgery	2006	0.696682	125
20	Indications for operation in abdominal trauma.	American Journal of Surgery	1960	0.685039	149
21	Work loads and practice patterns of general surgeons in the United States, 1995–1997: a report from the America Board of Surgery	Annals of Surgery	1999	0.680672	94
22	The “pinch-off sign”: a warning of impending problems with permanent subclavian catheters.	American Journal of Surgery	1984	0.672727	110
23	Bypass operations for neoplastic biliary tract obstruction.	American Journal of Surgery	1965	0.669903	46
24	Fluid therapy in hemorrhagic shock.	JAMA Surgery	1964	0.669872	206
25	Presidential address: the woman in the case. Jane Todd Crawford, 1763–1842.	Annals of Surgery	1979	0.666667	2
26	To impart this art: the development of graduate surgical education in the United States.	Surgery	1999	0.666667	23
27	Surgery in Belgium.	JAMA Surgery	1999	0.666667	2
28	Banthine as an adjunct in the treatment of salivary fistulas.	American Journal of Surgery	1956	0.666667	4
29	Successful microdermagrafting using the Meek-Wall microdermatome.	American Journal of Surgery	1958	0.666667	56
30	Treatment of large human burns with 0.5 per cent silver nitrate solution.	JAMA Surgery	1965	0.66318	214
31	Primary venous valve incompetence of the leg.	American Journal of Surgery	1980	0.65	45
32	Field articulation testing: a predictor of technical skills in surgical residents.	Journal of Surgical Research	1986	0.641026	39

(*continued on next page*)

Table 1 (*continued*)

Rank	Title	Journal	Year	Disruption Score	Citation Count
33	Mitral valvulotomy. II. Operative results after closed valvulotomy: a report of 500 cases.	American Journal of Surgery	1969	0.634615	14
34	The extension of cancer of the head and neck through peripheral nerves.	American Journal of Surgery	1963	0.631944	174
35	The median sternal incision in intracardiac surgery with extracorporeal circulation; a general evaluation of its use in heart surgery	Surgery	1957	0.628692	125
36	Peritoneo-venous shunting for ascites.	Annals of Surgery	1974	0.620087	166
37	Importance of profunda femoris artery in the revascularization of the ischemic limb.	JAMA Surgery	1961	0.617834	49
38	Continuous blood gas and pH monitoring during cardiovascular surgery.	American Journal of Surgery	1970	0.615385	4
39	Experience with intestinal plication and a proposed modification.	Annals of Surgery	1960	0.608696	36
40	Intestinal obstruction due to schistosomiasis.	American Journal of Surgery	1985	0.6	6
41	Long-term total parenteral nutrition with growth, development, and positive nitrogen balance.	Surgery	2001	0.587549	582
42	Diagnostic colonoscopy and colonoscopic polypectomy.	JAMA Surgery	1973	0.578947	19
43	Experience in autologous and allogenetic thyroid grafts.	Journal of Surgical Research	1967	0.571429	5
44	Surgery in Nigeria.	JAMA Surgery	1999	0.571429	16
45	A five-year prospective study of 23,649 surgical wounds.	JAMA Surgery	1973	0.570539	538
46	Intra-abdominal “reservoir” in patients with permanent ileostomy. Preliminary observations on a procedure resulting in fecal “continence” in five ileostomy patients	JAMA Surgery	1969	0.570447	299
47	Dermoid cysts of the spleen.	Annals of Surgery	1958	0.5625	6
48	Congenital absence of the ulna.	American Journal of Surgery	1965	0.56	20
49	Arterial embolism occurring during systemic heparin therapy.	JAMA Surgery	1958	0.55787	140
50	Management of hemorrhage from esophageal varices using the esophagoscopic sclerosing method.	Annals of Surgery	1973	0.557692	17
51	Siliconized Foley catheters.	American Journal of Surgery	1965	0.555556	4
52	Surgical correction of aortic insufficiency.	Surgery	1954	0.552419	101
53	Selective inductive heating of lymph nodes.	Annals of Surgery	1957	0.55157	208
54	Experimental studies on synthetic substitutes for skin and their use in the treatment of burns.	Annals of Surgery	1962	0.550725	27
55	Bilateral nephrectomy in chronic hemodialysis and renal transplant patients.	American Journal of Surgery	1973	0.55	12
56	Is fellowship training in alimentary tract surgery necessary?	American Journal of Surgery	1993	0.548387	20
57	A single-staged technique for seeding vascular grafts with autogenous endothelium.	Surgery	1978	0.548077	294
58	Surgical considerations of non-penetrating abdominal injuries: an analysis of 200 cases.	American Journal of Surgery	1960	0.546392	38
59	Pattern of recurrence in basal cell carcinoma.	Surgery	1965	0.54386	23
60	The surgical treatment of constrictive fibrous endocarditis.	Annals of Surgery	1981	0.533333	33
61	Elephantiasis of the penis and scrotum. A review of 350 cases.	American Journal of Surgery	1985	0.530612	30
62	Evaluation of results of surgical procedures in the elderly.	Annals of Surgery	1982	0.529412	58
63	Bilateral hip disarticulation in paraplegics with decubitus ulcers.	JAMA Surgery	1987	0.526316	5
64	Where National Board Examinations pass and fail in evaluating knowledge of surgical clerks.	Journal of Surgical Research	1979	0.52	4
65	One hundred cases of traumatic rupture of the spleen.	JAMA Surgery	1969	0.52	6
66	Renogram and other radioisotope tests in the diagnosis of renal hypertension.	American Journal of Surgery	1964	0.513514	9
67	Program directors in surgery agree that residents should be formally trained in business and practice management	American Journal of Surgery	2005	0.513514	35
68	Scalp as a donor site.	American Journal of Surgery	1977	0.512821	22
69	Gastrointestinal hemorrhage through the pancreatic duct.	Annals of Surgery	1970	0.511111	80
70	Radiological changes in pulmonary atelectasis.	JAMA Surgery	1965	0.509434	1
71	Squamous cell carcinoma of the oral tongue in patients less than thirty years of age.	American Journal of Surgery	1975	0.505618	98
72	Presidential address: academic surgery-points of view.	Surgery	1987	0.5	3
73	A study of Andrew Jackson's wounds and illnesses.	American Journal of Surgery	1969	0.5	1
74	The pursuit of excellence in graduate surgical education. Visions of the Arizona experience.	American Journal of Surgery	1980	0.5	1
75	A suture needle with a detachable point.	Surgery	1954	0.5	1
76	Perineal hernia following abdominoperineal resection.	American Journal of Surgery	1956	0.5	28
77	Parathyroid adenoma: a case report with unusual clinical features.	Annals of Surgery	1957	0.5	3
78	The role of the Miles abdominoperineal excision in the history of curative rectal cancer surgery.	Surgery	1960	0.5	2
79	Malignant melanoma: report of 203 patients.	Annals of Surgery	1964	0.5	12
80	X-ray visualization of surgical sponges.	Surgery	1955	0.5	2
81	Carcinoma of breast in children; case report: six-year-old boy with adenocarcinoma.	Annals of Surgery	1955	0.5	19
82	Pulmonary abscess in infancy and childhood: report of 18 cases.	Annals of Surgery	1960	0.5	11
83	The tension-free hernioplasty.	American Journal of Surgery	1989	0.499351	517
84	Healing of arterial prostheses in man: its incompleteness.	Annals of Surgery	1972	0.49692	251

Table 1 (*continued*)

Rank	Title	Journal	Year	Disruption Score	Citation Count
85	Surface infection with pseudomonas aeruginosa.	Annals of Surgery	1964	0.49635	46
86	Transvenous removal of pulmonary emboli by vacuum-cup catheter technique.	Journal of Surgical Research	1969	0.495798	49
87	Cancer of the colon: the influence of the no-touch isolation technic on survival rates.	Annals of Surgery	1967	0.495719	487
88	Vertical banded gastroplasty for obesity.	JAMA Surgery	1982	0.493488	257
89	The shin splint syndrome. Medical aspects and differential diagnosis.	American Journal of Surgery	1967	0.493151	40
90	Cost of treating advanced leg ischemia. Bypass graft vs primary amputation.	JAMA Surgery	1988	0.492308	45
91	Biliobiliary fistula. A trap in the surgery of cholelithiasis.	JAMA Surgery	1975	0.490196	30
92	The injured colon: therapeutic considerations.	American Journal of Surgery	1975	0.489796	19
93	Acute perforated tuberculous enteritis: surgical treatment.	Annals of Surgery	1959	0.488372	13
94	Mycotic aneurysms.	Annals of Surgery	1954	0.482143	51
95	William Halsted and Theodor Kocher: “an exquisite friendship".	Annals of Surgery	1978	0.481481	8
96	General surgery problems in patients with spinal cord injuries.	JAMA Surgery	1975	0.48	39
97	Cervico-thoracic approach for subclavian vessel injury from compound fracture of the clavicle: considerations	Annals of Surgery	1963	0.478261	20
98	Primary tumors in inguinal hernial sacs.	JAMA Surgery	1955	0.478261	18
99	Acceleration of healing with zinc sulfate.	Annals of Surgery	1967	0.472081	81
100	Replantation of uterus and ovaries in dogs, with successful pregnancy.	JAMA Surgery	1966	0.471074	42

Declaration of competing interest

None.

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None.

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