

# Current Comments®

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## The 101 Most-Cited Papers from the *British Medical Journal* Highlight the Important Role of Epidemiology in Medicine

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The *British Medical Journal* began publishing in 1840 as the organ of the Provincial Medical Association (PMA), a group of physicians practicing in the provinces outside England's major cities. They had banded together in 1832 to share their individual medical experiences with one another in much the same fashion as the metropolitan physicians who had earlier formed their own society and journal. The PMA's first periodical was called *The Provincial Medical and Surgical Journal*; in 1853 it merged with the *London Journal of Medicine* to become the *Association Medical Journal*. Four years later the PMA acknowledged its growing membership throughout Great Britain by renaming the society the British Medical Association. The journal was also renamed.<sup>1</sup> Today the *British Medical Journal* is the third largest general medical journal in the world<sup>2</sup> and, as the official organ of the British Medical Association, is sent free to its 70,000 members; the journal also has over 20,000 nonmember subscribers throughout the world.<sup>3</sup> (p. 239)

This weekly journal primarily publishes peer-reviewed, clinically oriented papers intended to "educate, inform, and entertain" physicians from academia to general practice to administration. These papers constitute about half of the journal's pages each week. The remaining pages of the journal comprise letters, book reviews, social-policy articles, topical items, and "leading articles" commissioned to keep physicians up-to-date with the latest advances in medicine and to explain their uses in clinical settings.

Every year over 5,000 items, including 2,900 letters, are submitted to the *British*

*Medical Journal*, but of these only 20 percent are eventually published.<sup>3</sup> (p. 243) The current editor, Stephen Lock, who authored a 1985 book on peer review in medicine,<sup>4</sup> follows extensive refereeing practices (a recent review of which appears in a 1986 article in *Scholarly Publishing*.<sup>5</sup>) He also subscribes to the rule promulgated by Franz Ingelfinger, former editor of the *New England Journal of Medicine*. The essence of the Ingelfinger rule is that articles submitted to a journal cannot have been previously published in, or be simultaneously submitted to, other journals.<sup>6</sup> The *British Medical Journal* is also a founding member of the International Committee of Medical Journal Editors—the Vancouver Group—which is responsible for issuing the Uniform Requirements for the Submission of Manuscripts to Biomedical Journals and guidelines on multiple publication. These requirements are now followed by over 300 biomedical journals throughout the world.

Since 1840 the *British Medical Journal* has published over 50,000 papers, letters, and other items. In this study my ISI® colleagues and I identified and then examined the 101 *British Medical Journal* items most cited in the 1955-1985 *Science Citation Index® (SCI®)*. (See Bibliography.) Of these, 99 are research papers and 2 (W.J. Irvine and A.W. Liley) are notes published in the preliminary communications section of the journal. The citations received by the 101 items range from 182 to 803. The median citation rate is 240. The notes received 186 (Irvine) and 264 (Liley) citations.

The articles in the Bibliography represent over 5 percent of those *British Medical Jour-*

nal items cited at least 50 times in the 1955-1985 *SCI*. Table 1 provides the citation breakdown, by groups of 100 citations or less, for those *British Medical Journal* articles cited 50 or more times. Only 9 items have received 400 or more citations; 28, more than 300; and 73, at least 200 citations. The majority of the articles—1,029—were cited between 50 and 74 times.

### Methods

As mentioned earlier, the 101 articles were chosen by examining citation data culled from the 1955-1985 *SCI*. Only citations from journals and other serials are included. While the *SCI* does include citations to textbooks and other monographs, they are not treated as sources. The purpose of this analysis was simply to identify the 100 most-cited "classic" articles from this prestigious medical journal. Using citation counts as the sole selection criterion, we previously identified a similar series of *Citation Classics*® for the *Annals of Internal Medicine*,<sup>7</sup> *JAMA—Journal of the American Medical Association*,<sup>8</sup> *The Lancet*,<sup>9</sup> and the *New England Journal of Medicine*.<sup>10</sup> No hypotheses were proposed about the types of items that might appear in the list.

Selection of papers was limited by the 31 years of citation data covered by the 1955-1985 *SCI*. Understandably, older papers that received the bulk of their citations prior to 1955 were not identified. This problem will be remedied, however, once the *SCI* is extended back to include citations from papers published in the first half of the twentieth century.

### Five Most-Cited Papers and *Citation Classics*

The most-cited paper in the Bibliography, by Andrew W. Kay, Western Infirmary, University of Glasgow, Scotland (803 citations), describes the "Effect of large doses of histamine on gastric secretion of HCl," or "the parietal cell response in man to large doses of histamine."<sup>11</sup> It is now over 30 years old but continues to be cited occasionally. The second most-cited work is of more recent vintage. Published in 1977 by M.B. Skirrow, Public Health Laboratory,

Worcester Royal Infirmary, the paper discusses campylobacter enteritis.

B.N.C. Prichard and P.M.S. Gillam, University College Hospital Medical School, University of London, authored "Treatment of hypertension with propranolol," the third most-cited paper, with 520 citations. This 1969 paper continues to be cited—12 times in 1986.

As yet, the authors of these three papers have not published commentaries in the *Citation Classics* series that appears in *Current Contents*® each week. These are autobiographical accounts of informal events leading up to a paper's publication. However, Alice M. Stewart, Department of Social Medicine, University of Oxford, one of the authors of the fourth most-cited article, did comment on the survey of childhood malignancies she wrote with Josefine Webb and David Hewitt, also then at Oxford. According to Stewart's commentary, their work was "a triumph for a small group of epidemiologists...[who] were anxious to discover why the post-war increase in leukemia had produced an early peak of leukemia mortality consisting only of lymphatic cases, but...even with the increase, leukemia remained a rare cause of childhood deaths." An association between fetal irradiation and cancer was later identified by the group.<sup>12</sup>

The fifth most-cited work, by Martin G. Lewis, Chester Beatty Research Institute, Institute of Cancer Research: Royal Cancer Hospital and Royal Marsden Hospital, London, and six colleagues, has been referenced 445 times since 1969. In his commentary Lewis says that this work "resulted in one of the first detailed studies of humoral immunity in a human tumor system."<sup>13</sup> At the end of his commentary, which illustrates the type of information not usually included in scientific papers and that authors are encouraged to share in *Citation Classics*, he also relates the sad news that three of his coauthors—D.C. Bodenham, R.L. Ikonoisov, and G. Hamilton Fairley—are deceased, the latter the victim of a terrorist bomb attack in London.<sup>13</sup>

Seven additional papers in the Bibliography, two coauthored by W.H.W. Inman,

**Table 1:** Citation-frequency distribution of *British Medical Journal* articles cited 50 or more times in the 1955-1985 *SCF*<sup>®</sup>. A total of 1,969 articles were examined.

Number of Citations	Number of Articles	Percent of Total Articles Examined
500	4	0.2
400-499	5	0.3
300-399	19	1.0
200-299	45	2.3
100-199	432	22.0
75-99	435	22.1
50-74	1,029	52.3

Committee on Safety of Medicines, London, about the relationship of oral contraceptive use to thromboembolic disease, have been discussed in *Citation Classics* commentaries. The other five papers were authored by D.J.R. Laurence, M.O. Thorner, F.E. Speizer, M.P. Vessey, and B.M. Wright. Vessey's paper, coauthored with Sir Richard Doll, also discusses oral contraceptives and venous thromboembolism. Vessey, incidentally, is also coauthor on both of the Inman articles.

#### Author Information

Numerous studies at ISI have demonstrated that Nobel Prize winners consistently publish classic papers. However, only one of the authors in the list of 101 *British Medical Journal* articles, Sir Peter Brian Medawar (UK), is a Nobel laureate. He was honored in 1960 with Sir Frank Macfarlane Burnet (Australia), recently deceased, for their discovery of acquired immunological tolerance. Medawar is represented in the Bibliography by two papers written with first authors R.E. Billingham, then at the University of Birmingham, and L. Brent, National Institute of Medical Research, Medical Research Council (MRC), London. These works discuss skin homografts and tissue transplantation, activities that proved important to the later Nobel Prize-winning research on acquired immunological tolerance. According to Medawar, "he was terribly sorry that the [Nobel] distinction could not be so far subdivided as to have included my friends Bill [Billingham] and Leslie [Brent]." <sup>14</sup> (p. 137)

Until his recent illness, Medawar was director of the National Institute of Medical

Research at Mill Hill. His autobiography<sup>14</sup> has recently appeared. While the number of distinguished physicians in the Bibliography is obvious, the Nobel Prize reflects basic preclinical research.

Exactly 303 authors appear on the 101 papers. Doll is listed on 11 of these, while Vessey wrote 5, G.M. Besser and A.B. Hill each are represented by 4, K.G.M.M. Alberti, R. Hall, Inman, and A.S. McNeilly authored 3 each, and 23 authors wrote 2 papers. Many of the papers by these authors are companion pieces on the same subject published back-to-back in the *British Medical Journal* (N. Hurwitz, J.I. Mann, Speizer) or similar papers published within a year of one another (I. Aird, Doll, Vessey); three of Doll's works contain the results of an original study (two 1964 papers) and a follow-up published in 1976.

However, each of these "paired" papers contained enough unique information that researchers cited them more often by themselves than in conjunction with their companion papers. For example, 101 articles co-cited both of Aird's papers that examine the relationship of blood groups to various types of cancer. The 1953 paper received an additional 213 citations and the 1954 article, 165 citations from 1955 to 1985. Doll has three papers in the Bibliography that discuss mortality in relation to smoking. Thirteen articles co-cited these papers. However, 162 co-cited the two 1964 papers.

The two Hurwitz papers in the Bibliography were published back-to-back in the *British Medical Journal* in 1969, but they have been co-cited in only 32 articles. However, Mann's articles on oral contraceptives and myocardial infarction, also published consecutively, in a 1975 issue of the journal, were co-cited together in 127 papers, while Speizer's two papers were similarly co-cited in 122 articles. The full citation count for each paper can be found in the Bibliography.

#### Multiple Authorship and Age of Papers

In the past 20 years various scholars have noted a growing trend toward multiple authorship of scientific papers. Papers published in journals such as *The Lancet*, *New*

*England Journal of Medicine, Annals of Internal Medicine, and Surgery, Gynecology, and Obstetrics* have all experienced a rise in mean authorship in the last decade.<sup>15-17</sup>

In this study only 12 papers list just one author. Of the remainder, 31 have 2 authors; 18, 3; 18, 4; 8, 5; 2, 6; 3, 7; 3, 8; 4, 9; 1, 10; and 1, 11. Of course, the group of papers in the Bibliography is only a small sampling of articles drawn from just one journal, and the papers' publication dates are clustered rather heavily in two decades. Forty-three articles were published in the 1970s, 38 in the 1960s, and 18 in the 1950s. Table 2 provides the chronologic distribution of all 101 papers by decade of publication.

**Table 2:** Chronologic distribution of publication dates of the 101 *British Medical Journal* papers most cited in the 1955-1985 *SCJ*<sup>®</sup>.

Decade of Publication	Number of Papers
1920s	1
1930s	0
1940s	0
1950s	18
1960s	38
1970s	43
1980s	1

T.J. Crow, Division of Psychiatry, Clinical Research Centre, MRC, London, wrote the most recent paper in the Bibliography, a 1980 review on the molecular pathology of schizophrenia. It is the only paper in the table from the 1980s. The oldest paper is A. Cecil Alport's 1927 article on "Hereditary familial congenital haemorrhagic nephritis," cited 235 times between 1955 and 1985. The second oldest paper, from 1951, was mentioned earlier, authored by Billingham, P.L. Krohn, and Medawar.

#### Geographic and Institutional Information

Alport was affiliated with the University of London, St. Mary's Hospital Medical School, 1 of 73 institutions listed by the authors of the 101 papers. Seventeen of these affiliations appear more than once in the list. The three with the greatest number of papers are the University of London, the MRC, and the University of Oxford. These institutions in turn represent many smaller colleges and schools, which are itemized in Table 3. For

example, the University of London, listed 54 times by authors in the Bibliography, includes 13 papers from St. Bartholomew's Hospital Medical College, while the MRC, with a total of 21 papers, has 10 from its Biostatistics Unit in Cambridge.

**Table 3:** Itemized breakdown of the three affiliations that appear most often in the Bibliography.

Name of Institution	Number of Times Institution Appeared in the Bibliography
University of London	54
St. Bartholomew's Hospital Medical College	13
University College Hospital Medical School	12
King's College Hospital Medical School	7
Royal Postgraduate Medical School	7
London School of Hygiene & Tropical Medicine	4
Middlesex Hospital Medical School	4
Guy's Hospital Medical School	2
St. Thomas's Hospital Medical School	2
Institute of Child Health	1
London Hospital Medical College	1
St. Mary's Hospital Medical School	1
MRC (Medical Research Council)	21
Biostatistics Unit, Cambridge	10
National Institute of Medical Research, London	3
Clinical Effects of Radiation Research Unit, Edinburgh	1
Clinical Research Centre, London	1
Demyelinating Disease Unit, Newcastle upon Tyne	1
Epidemiology Unit, Cardiff	1
Gastroenterology Unit, London	1
Group Metabolic Haemodynamic Liver Disease, London	1
MRC	1
Social Medical Research Unit, London	1
University of Oxford	13
Radcliffe Infirmary	6
Department of Social and Community Medicine	2
Nuffield Department of Clinical Medicine	2
Department of Pharmacology	1
Department of Social Medicine	1
University Laboratory of Physiology	1

All the institutions represented are located in just 12 countries; not surprisingly, the UK has the greatest number of papers—90. The

**Table 4:** Geographic areas represented by the 101 *British Medical Journal* papers most cited in the 1955-1985 *SCI*<sup>®</sup>, in descending order of the number of papers produced.

Country	Number of Papers	Number of Multinational Collaborations	Institutional Nationality of Collaborators
UK	90	6	Australia, Bulgaria, Denmark, S. Africa, Sweden, US
England	82		
Scotland	6		
N. Ireland	3		
Wales	3		
Denmark	4	1	Sweden, UK
Sweden	4	3	Denmark, UK, US
Finland	3	0	
US	3	2	Sweden, UK
Australia	2	1	Bulgaria, UK
S. Africa	2	2	UK
Bulgaria	1	1	Australia, UK
New Zealand	1	0	

gap between it and the two next most-listed countries—Denmark and Sweden with four each—is quite large. (See Table 4.) According to the *British Medical Journal*, about 25 percent of the articles they now receive and publish every year are from authors overseas.<sup>2</sup>

### Conclusion

This concludes our study of the 101 most-cited *British Medical Journal* items. While citation counts alone do not always identify important papers, they can help us quickly recognize articles that contain lasting or con-

troversial research. See, for example, our recent study of the 100 most-cited papers from *JAMA—Journal of the American Medical Association*,<sup>8</sup> which compared their landmark series<sup>18</sup> to our list of 100 articles.

The citation and source-item data contained in the *SCI* and used in this study can also be separated into specific categories for more sophisticated analyses of journals and articles. For example, the types of journal items—letters, original articles, reviews, and so on—that give out and receive references can be identified, and then these can be examined to ascertain which types are most cited. Impact factor, the average number of citations given to a journal's articles during a specified period of time, can also be calculated to help normalize the varying rates of citation between journals from different fields. Two recently published articles use *SCI* data, obtained from customized computer printouts prepared by ISI, to examine general medical journals such as the *British Medical Journal* and the *New England Journal of Medicine*.<sup>19,20</sup>

Unfortunately, it is not within the scope of this essay to discuss all the different ways that *SCI* data can be used to analyze articles and journals.

\* \* \* \* \*

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The 101 most-cited *British Medical Journal* articles from the 1955-1985 *SCI*<sup>®</sup>, in alphabetic order by first author. Asterisks (\*) indicate articles with *Citation Classics*<sup>®</sup> commentaries. The issue number, year, and edition of *Current Contents*<sup>®</sup> in which these commentaries appeared are in parentheses. Readers should be aware when scanning this table that the *British Medical Journal*'s system of numbering each volume changed in 1980 from a yearly cycle of volume numbers to a consecutive volume numbering system carried over from one year to the next. They started with #280 rather than #1 to account for the earlier volumes of the journal that had been numbered 1, 2, 3, or 4 each year.

1955-1985

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