Citation Classics in Radiology Journals: The 100 Top-Cited Articles, 1945–2012

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OBJECTIVE. The number of citations an article receives after its publication reflects its impact in the scientific community. The aim of this study was to identify and characterize the 100 top-cited articles published in radiology journals.

MATERIALS AND METHODS. The top-cited articles published in 12 radiology journals were identified using the database of Science Citation Index Expanded (1945–2012). The 100 top-cited articles were selected and analyzed with regard to the number of citations, year of publication, publishing journal, authorship, institution and country of origin, type of article, radiologic subspeciality, main topic, and radiologic technique.

RESULTS. The 100 top-cited articles were published in eight radiology journals, led by Radiology (n = 67) and followed by the American Journal of Roentgenology (n = 11). These articles were published between 1939 and 2006 with a mean of 664.3 citations per article (range, 371–6931). Seventy-eight articles were published after 1979, 57 originated from the United States, and 69 were original articles. The most common subspecialties of study were interventional radiology (n = 19), neuroradiology (n = 15), and breast imaging (n = 11). The main topics of articles were radiofrequency ablation of hepatic tumors (n = 9), followed by receiver operating characteristic curves (n = 6).

CONCLUSION. Our study presents a detailed list and analysis of the 100 top-cited articles published in radiology journals, which provides insight into historical developments in the field of radiology.
Selection of Journals

We identified 113 journals indexed in the Science Citation Index and Science Citation Index Expanded listed under the subject category “radiology, nuclear medicine and medical imaging” on the Web of Knowledge Journal Citation Reports Science Edition 2010 [14]. Among them, 63 journals were excluded from analysis because their contents are beyond the scope of most radiologists’ daily practice. They were journals specializing in radiation physics (n = 24), nuclear medicine (n = 14), radiation therapy (n = 12), radiation protection (n = 5), cardiology (n = 4), surgery (n = 2), obstetrics and gynecology (n = 1), and contrast media (n = 1). Decisions were reached by consensus of two authors (board-certified radiologists with 17 and 12 years’ experience, respectively) and were based on the title of the journal and by information contained in the “Instructions to Authors” and the Table of Contents of a sample issue. The remaining 50 journals were considered journals specifically dedicated to radiology and radiologists. Of these, we selected the 10 journals with the highest impact factors (IFs) [14]: Radiology (IF = 6.069), Investigative Radiology (IF = 4.670), European Radiology (IF = 3.594), American Journal of Neuroradiology (IF = 3.464), European Journal of Radiology (IF = 2.941), Neuroradiology (IF = 2.870), AJR (IF = 2.797), RadioGraphics (IF = 2.760), Academic Radiology (IF = 2.195), and Radiologic Clinics of North America (IF = 2.163). Acta Radiologica (IF = 1.486) and British Journal of Radiology (IF = 2.062) were also included because of their historical value in radiologic literature; the first issues of Acta Radiologica and British Journal of Radiology were published in 1921 and 1928, respectively.

Data Search

The 100 top-cited articles in these 12 radiology journals were identified in June 2012 using the search tools in the Web of Knowledge–Web of Science database [15] (January 1945 to June 2012). The Web of Knowledge–Web of Science is a multidisciplinary database with searchable author abstracts covering the journal literature of the sciences; it fully indexes more than 8000 major journals across 174 subject categories, providing access to current information and retrospective data from 1945 forward, and contains more than 17 million records, with an average of 19,000 new records added per week [15].

A search using the Cited Reference Search option of the database was performed by typing the name of each journal under Publication Name, and results were sorted by the category Times Cited. This search provided a list of all articles appearing in a given journal ranked by citation count. The Cited Reference Search option of the Web of Knowledge returns a site-configured maximum number of results limited to 500. To obtain more than the maximum number of results, the data were searched in segments by, for example, searching for data 1 year or one journal at a time. The database for this study was compiled in June 2012, and the numbers presented thus reflect the citation counts at that time. The 100 top-cited articles in the 12 radiology journals were identified and ranked solely according to the number of citations (Table 1).

Analysis of Articles

We performed a PubMed search to obtain the full texts or abstracts of articles that were available online. When relevant information was not available online, the articles were obtained in printed format by direct library access.

The 100 top-cited articles were analyzed and the data were tabulated according to their specific characteristics including ranking (number of citations), year of publication, publishing journal, authorship, institution and country of origin, type of article, radiologic subspecialty, main topic, and radiologic technique. For the purpose of our research, the institution and country of origin were defined by the address provided for the first author. The type of article was classified as an original article, review article, technical report, methodologic study, guideline, editorial, pictorial essay, meta-analysis, or case report. The radiologic subspecialty was categorized as abdominal, breast, cardiac, chest, genitourinary, head and neck, interventional, musculoskeletal including the spine, neuroradiology, pediatric, physics, radiation oncology, vascular, or miscellaneous (i.e., not conforming to one of the categories listed). The radiologic technique was classified as conventional radiography, mammography, angiography, sonography, CT, MRI, interventional technique, nuclear medicine, mixed (i.e., more than one radiologic technique used), or others (i.e., not conforming to one of the categories listed).

Two study investigators reviewed all articles independently. In cases of disagreement, a third reviewer (a board-certified radiologist with 9 years’ experience) was included in the discussion until consensus was achieved.

For trend analysis, we arbitrarily divided the years of publication into 1939–1989 (early period, n = 47) and 1990–2006 (late period, n = 53). The country of origin, type of article, subspecialty, and radiologic technique were compared between early and late periods using the chi-square test. Statistical analyses were performed using software (SPSS, version 19.0, SPSS) for Microsoft Windows, and a p value of < 0.05 was considered statistically significant.

Results

The 100 articles published in radiology journals that received the most citations from January 1945 to June 2012 are listed by rank order in Table 1. The most-cited article received 6931 citations, and the least-cited article received 371 citations. The mean number of citations per article was 664.3 and there were nine articles that received more than 1000 citations. The two most cited articles were both authored by J. A. Hanley and B. J. McNeil and were published in 1982 and 1983, describing the principle of receiver operating characteristic (ROC) curve for comparing the performance of diagnostic technology (Table 1).

The 100 top-cited articles were published in eight journals, led by Radiology (n = 67) and distantly followed by the AJR (n = 11) (Table 2). The earliest article was published in 1939 (Jonsell, Acta Radiologica) and the most recent article, in 2006 (Flohr, European Radiology). Table 3 shows the distribution of the 100 articles by decade of publication. The decade with the greatest number of top-cited articles was the 1990s (n = 42), followed by the 1980s (n = 25) and the 2000s (n = 11).

We found 12 “frequent authors” who contributed three or more of the top-cited articles (Table 4). This list is led by Livraghi, who authored or coauthored seven of the articles; he is also the only person who is first author of four of the articles. Authors from 69 different institutions wrote the 100 top-cited articles; 18 articles did not originate in a radiology department (e.g., departments of gastroenterology, biophysics, epidemiology and health, surgery, pediatrics, and psychology). The most active institute in the production of the top-cited radiology articles was the Department of Radiology at Massachusetts General Hospital, which was the institution of the first authors of seven of the top-cited articles during the period 1988–2001 (Table 5). The 100 top-cited articles originated from nine countries, with the United States contributing 57 articles, followed by Italy with 10 articles (Table 6).

Other variables, including the type of article, subspecialty, main topic, and radiologic technique in the 100 top-cited articles, are summarized in Tables 7–10.

In the time trend analysis, the United States’ share declined from 61.7% (29/47) in 1939–1989 to 52.8% (28/53) in 1990–2006, but this decline did not reach statistical significance (p = 0.4889). The number of original articles represented 46.8% (22/47) of the classic articles in 1939–1989 and significantly increased to 84.9% (45/53) in 1990–2006 (p = 0.0001). The interventional subspecialty (from 8.5% [4/47] to 28.3% [15/53], p = 0.0237) showed a statistically significant increase, whereas the musculoskeletal imaging and radiation on-
Radiology is a specialty of medicine that uses medical imaging techniques to assess patient condition and administer treatment. With the advance of technology, radiology has been a rapidly developing field through recent years and many interesting and important observations have been made. This development can be evidenced, in part, by the large number of articles published by experts in the scientific literature.

In our study, we identified and characterized the 100 top-cited articles in radiology journals. The value of identifying these classic articles is that they help to provide insights into how radiology has evolved over time and to define researchers who have made outstanding contributions in this field. Furthermore, analysis of the top-cited articles not only reveals the characteristics of articles that had a significant impact on the field of radiology but also reveals the trends and some important advances in radiologic research.

The 100 top-cited articles in radiology were cited between 371 and 6931 times. Indeed, citation rates differ for each specialty and might depend on the size of the scientific community. However, the number of citations in our study is higher than that observed in other large specialties such as obstetrics and gynecology, in which studies received from 312 to 1090 citations from 1956 to 2009 [6].

The 100 top-cited articles were published in eight radiology journals. Among them, two major U.S. radiology journals (Radiology and the AJR) published 78% of the top-cited articles. The IF of the original publishing journal is widely considered one of the predictors of the citation classics [16, 19]. Our analysis showed that 78% of the citation classics were published after 1979. This trend can be explained by the increase in published articles, development of bibliographic databases, and wide use of the Internet in formal searches of the literature in recent decades.

Our study also showed that 5% of the 100 top-cited articles originated from academic institutions in the United States. This finding confirms the overwhelming influence of the United States on radiology research, although our results are less concentrated in the United States compared with anesthesiology journals (69% U.S. articles) [7], clinical dermatologic journals (75%) [8], general surgical journals (78%) [9], and otolaryngology and head and neck surgery journals (84%) [10]. This U.S. dominance can be explained by the large size of the U.S. radiologic community, its abundant financial resources, and a tendency for U.S. authors to cite local papers [17].

With regard to the type of articles, our results showed that original articles accounted for 67% of all radiologic citation classics, which is in line with several studies of top-cited articles in different fields [6, 7, 9]. In addition, the number of original articles showed a statistically significant increase from the early to the late period. This trend may indicate a recent preference for citing clinical or experimental evidence rather than an expert opinion or summary of the literature.

Another trend in the radiologic citation classics was a significant growth in the interventional subspecialty, reflecting major advances in the field after the 1990s such as primary cancer treatments and stent-grafts. Nevertheless, interventional radiology still represents the radiologic subspecialty with the greatest number of citation classics. Interventional radiology is a constantly developing subspecialty that combines imaging techniques with minimally invasive therapeutic procedures performed under radiologic guidance. Consequently, articles in this subspecialty appeal not only to radiologists but also to researchers in other disciplines. Closer examination of the 19 articles in the interventional radiology subspecialty revealed that nine (47%) were related to radiofrequency ablation of hepatic tumors, which was the most common topic discussed in the top-cited articles (Table 9). Interestingly, the second most common topic in our study was the ROC curve, reflecting that such a powerful method could have a profound impact on a wide range of scientific investigations.

Last, MRI was the most common radiologic technique used in the 100 top-cited articles (Table 10). This trend is different from that observed by Chew [11] in his study of citation classics from 1955 to 1986 in a single radiology journal (the AJR). He identified conventional radiography and CT as the most commonly used radiologic techniques. This difference is probably related to the recent incorporation of MRI into the radiology mainstream; MRI has since replaced conventional radiography and CT as the imaging technique of choice in many fields of radiology.

One would expect that the popularity of a topic, striking originality, and brilliant ideas play an important role in citations. However, previous reports in the literature suggest that citations depend not only on the quality of the article but also on many other factors [20, 21]. Although the number of citations is considered one of several valid indicators in identifying classic articles [1, 2], there are inherent biases that may interfere with the generation of a representative list of classic articles based on the absolute number of citations.

First, the sum of the citations of an article is logically dependent on its publication year because citations accumulate over time; older articles are likely to be cited more frequently than recent articles. Typically, scientific articles are not cited until 1–2 years after publication and reach a maximum after 3–10 years, at which time they continue to be cited but at a less frequent rate [22, 23]. This normal life span of an article may result in underestimation of recently published articles irrespective of their actual impact [16, 19]. To overcome this problem, the “citation index,” defined as the number of citations divided by the number of years since publication, can be used instead of the total number of citations for evaluating the impact of an article on the scientific community [24].

Second, even important citation classics are gradually cited less often as time passes because their substance is absorbed by the current knowledge—a phenomenon called “obliteration by incorporation” [5]. As is the case in the citation classics identified in this study, the true intellectual milestones may often be found in the reference lists of the top-cited articles.

Third, another problem of citation behavior is so-called “incomplete citing.” It is well recognized that the reasons for citing specific articles may not be entirely appropriate. There are various types of conscious or unconscious incomplete citing biases that may affect citation rates, such as self-citation, citing high-IF journals and review articles, omission bias (i.e., bias toward not referenc-
ing competitors or sources contradictory to one’s own results), and national or language preferences [25, 26].

To our knowledge, this study is the first reported attempt to identify all top-cited articles in the field of radiology. The features of radiologic classics have been investigated in 1988 and 2006 on the basis of the citation ratings of a single journal [11–13]. Eleven articles in Bui-Mansfield’s list of the 100 top-cited articles published in the AJR [13] continued to be frequently cited and appeared in our list. Although the top two articles [27, 28] did not change in ranking, three articles decreased [29–31] and six articles increased [32–37] in the AJR ranking since 2006. The increase in ranking of some classic articles is associated with diseases of growing importance, topics that appeal to a broad audience of physicians, and major developments in the subspecialty. For example, two articles by Rossi et al., “Percutaneous RF interstitial thermal ablation in the treatment of hepatic cancer” [33] (2006: rank 19, 259 citations; 2012: rank 4, 515 citations) and “Percutaneous treatment of small hepatic tumors by an expandable RF needle electrode” [36] (2006: rank 52, 202 citations; 2012: rank 9, 405 citations) had the sharpest rise in the AJR ranking. For the past decades, this interventional technique has changed diagnostic and therapeutic algorithms for hepatic tumors. Therefore, many hepatologists, surgeons, and radiologists have frequently cited the articles by Rossi et al. in their articles.

The citation analysis presented in our study has some potential limitations that need to be considered. First, we limited our survey to documents published in the 12 radiology journals that have the highest IFs or have historical importance; consequently, top-cited articles in other radiology journals may have been excluded from the list. It is almost impossible to perform a manual search of all radiology journals because of the exorbitant number of articles. Second, we considered only articles originally published in radiology journals. It is likely that some of the most important and frequently cited articles within the field of radiology have been published in general medical journals with higher impact and broader readership such as the New England Journal of Medicine or the Journal of the American Medical Association. Therefore, some radiology citation classics that were originally published in other general medical or specialty journals may have been excluded from this list. Finally, although the Web of Knowledge is the most commonly used database for citation analysis, our results might have been slightly different if another citation database had been used.

In conclusion, our study presents a detailed list and analysis of the 100 top-cited articles published in radiology journals, thereby providing insights into historical developments and information for researchers about producing a frequently cited article.

References

2. Garfield E. Citation analysis as a tool in journal evaluation. Science 1972; 178:471–479
3. Givold SE. Citation analysis and journal impact factors: is the tail wagging the dog? Acta Anesthesiol Scand 1999; 43:971–973
11. Chew FS, AJR: the 50 most frequently cited papers in the past 50 years. AJR 1988; 150:227–233
13. Bui-Mansfield LT. Top 100 cited AJR articles at the AJR’s centennial. AJR 2006; 186:3–6
15. Web of Knowledge–Web of Science database [database online]. City, State or Country of publisher: publisher’s name, year of publication and/or date of last update. URL. Access date
23. Marx W, Schier H, Wantanschek M. Citation analysis using online databases: feasibilities and shortcomings. Scientometrics 2001; 52:59–82
32. Wolfe JN. Breast patterns as an index of risk for developing breast cancer. AJR 1976; 126:1130–1137
35. Weissleder R, Stark DD, Engelstad BL, et al. Su-

Yoon et al.
Citation Classics in Radiology Journals

Table 1: The 100 Top-Cited Articles in Radiology Journals Ranked in Order of the Number of Citations Received

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Article</th>
<th>No. of Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hanley JA, McNeil BJ. The meaning and use of the area under a receiver operating characteristic (ROC) curve. <em>Radiology</em> 1982; 143:29–36</td>
<td>6931</td>
</tr>
<tr>
<td>7</td>
<td>Gray LH, Conger AD, Ebert M, Hornsey S, Scott OC. The concentration of oxygen dissolved in tissues at the time of irradiation as a factor in radiotherapy. <em>Br J Radiol</em> 1953; 26:638–648</td>
<td>1171</td>
</tr>
</tbody>
</table>

(Table 1 continues on next page)
<table>
<thead>
<tr>
<th>Ranking</th>
<th>Article</th>
<th>No. of Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>Wolfe JN. Breast patterns as an index of risk for developing breast cancer. <em>AJR</em> 1976; 126:1130–1137</td>
<td>551</td>
</tr>
</tbody>
</table>

(Table 1 continues on next page)
TABLE 1: The 100 Top-Cited Articles in Radiology Journals Ranked in Order of the Number of Citations Received (continued)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Article</th>
<th>No. of Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>69</td>
<td>Dorfman DD, Berbaum KS, Metz CE. Receiver operating characteristic rating analysis: generalization to the population of readers and patients with the jackknife method. <em>Invest Radiol</em> 1992; 27:723–731</td>
<td>426</td>
</tr>
<tr>
<td>71</td>
<td>Cameron JR, Mazess RB, Sorenson JA. Precision and accuracy of bone mineral determination by direct photon absorptiometry. <em>Invest Radiol</em> 1986; 3:141–150</td>
<td>419</td>
</tr>
<tr>
<td>80</td>
<td>Jonsell S. A method for the determination of the heart size by teleroentgenography (a heart volume index). <em>Acta Radiol</em> 1939; 20:325–340</td>
<td>402</td>
</tr>
</tbody>
</table>
TABLE 1: The 100 Top-Cited Articles in Radiology Journals Ranked in Order of the Number of Citations Received (continued)

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Article</th>
<th>No. of Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>84</td>
<td>Swets JA. ROC analysis applied to the evaluation of medical imaging techniques. <em>Invest Radiol</em> 1979; 14:109–121</td>
<td>394</td>
</tr>
</tbody>
</table>


*aTwo articles have the same rank because they have an equal number of citations.*
TABLE 2: Journals in Which the 100 Top-Cited Articles Were Published

<table>
<thead>
<tr>
<th>Journal</th>
<th>No. of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiology</td>
<td>67</td>
</tr>
<tr>
<td>American Journal of Roentgenologya</td>
<td>11</td>
</tr>
<tr>
<td>Investigative Radiology</td>
<td>7</td>
</tr>
<tr>
<td>British Journal of Radiology</td>
<td>7</td>
</tr>
<tr>
<td>European Radiology</td>
<td>7</td>
</tr>
<tr>
<td>American Journal of Neuroradiology</td>
<td>2</td>
</tr>
<tr>
<td>Radiologic Clinics of North America</td>
<td>2</td>
</tr>
<tr>
<td>Acta Radiologica</td>
<td>2</td>
</tr>
<tr>
<td>European Journal of Radiology</td>
<td>0</td>
</tr>
<tr>
<td>Neuroradiology</td>
<td>0</td>
</tr>
<tr>
<td>RadioGraphics</td>
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</tr>
<tr>
<td>Academic Radiology</td>
<td>0</td>
</tr>
</tbody>
</table>


TABLE 3: Distribution of the 100 Top-Cited Articles in Radiology Journals by Decade of Publication

<table>
<thead>
<tr>
<th>Decade</th>
<th>No. of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930–1939</td>
<td>1</td>
</tr>
<tr>
<td>1940–1949</td>
<td>1</td>
</tr>
<tr>
<td>1950–1959</td>
<td>3</td>
</tr>
<tr>
<td>1960–1969</td>
<td>6</td>
</tr>
<tr>
<td>1970–1979</td>
<td>11</td>
</tr>
<tr>
<td>1980–1989</td>
<td>25</td>
</tr>
<tr>
<td>1990–1999</td>
<td>42</td>
</tr>
<tr>
<td>2000–2009</td>
<td>11</td>
</tr>
<tr>
<td>2010–2012</td>
<td>0</td>
</tr>
</tbody>
</table>

TABLE 4: Authors Who Contributed Three or More of the Top-Cited Articles in Radiology Journals

<table>
<thead>
<tr>
<th>Author</th>
<th>No. of Articles</th>
<th>Position on Author List (No. of Articles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livraghi T</td>
<td>7</td>
<td>First (4), second (1), fourth (1), fifth (1)</td>
</tr>
<tr>
<td>Solbiati L</td>
<td>6</td>
<td>First (3), second (1), fifth (1), sixth (1)</td>
</tr>
<tr>
<td>Goldberg SN</td>
<td>6</td>
<td>Second (3), third (2), sixth (1)</td>
</tr>
<tr>
<td>Gazelle GS</td>
<td>6</td>
<td>Fourth (1), sixth (1), seventh (1), eighth (1), ninth (1), 11th (1)</td>
</tr>
<tr>
<td>Meloni F</td>
<td>5</td>
<td>Third (1), fourth (2), fifth (2)</td>
</tr>
<tr>
<td>Weissleder R</td>
<td>4</td>
<td>First (3), second (1)</td>
</tr>
<tr>
<td>Ierace T</td>
<td>4</td>
<td>Second (1), third (1), fourth (1), fifth (1)</td>
</tr>
<tr>
<td>Metz CE</td>
<td>3</td>
<td>First (2), third (1)</td>
</tr>
<tr>
<td>Remy-Jardin M</td>
<td>3</td>
<td>First (2), sixth (1)</td>
</tr>
<tr>
<td>Lazzaroni S</td>
<td>3</td>
<td>Third (2), ninth (1)</td>
</tr>
<tr>
<td>Norman D</td>
<td>3</td>
<td>Fourth (1), eighth (2)</td>
</tr>
<tr>
<td>Halpern EF</td>
<td>3</td>
<td>Fifth (1), eighth (1), ninth (1)</td>
</tr>
</tbody>
</table>

TABLE 5: Institutions of Origin for First Authors of Three or More of the Top-Cited Articles in Radiology Journals

<table>
<thead>
<tr>
<th>Department, Institution (Country)</th>
<th>No. of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Radiology, Massachusetts General Hospital (United States)</td>
<td>7</td>
</tr>
<tr>
<td>Department of Radiology, University of Oregon (United States)</td>
<td>4</td>
</tr>
<tr>
<td>Department of Radiology, Ospedale Civile (Italy)</td>
<td>4</td>
</tr>
<tr>
<td>Department of Radiology, University of California (United States)</td>
<td>3</td>
</tr>
<tr>
<td>Department of Radiology, Hospital of the University of Pennsylvania (United States)</td>
<td>3</td>
</tr>
</tbody>
</table>

Note—For the purpose of our research, institution and country of origin were defined by the address provided for the first author.
### TABLE 6: Countries of Origin of the 100 Top-Cited Articles in Radiology Journals

<table>
<thead>
<tr>
<th>Journal</th>
<th>No. of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>57</td>
</tr>
<tr>
<td>Italy</td>
<td>10</td>
</tr>
<tr>
<td>Germany</td>
<td>9</td>
</tr>
<tr>
<td>France</td>
<td>7</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>6</td>
</tr>
<tr>
<td>Japan</td>
<td>5</td>
</tr>
<tr>
<td>Sweden</td>
<td>3</td>
</tr>
<tr>
<td>Canada</td>
<td>2</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>1</td>
</tr>
</tbody>
</table>

Note—For the purpose of our research, institution and country of origin were defined by the address provided for the first author.

### TABLE 7: Types of Article of the 100 Top-Cited Articles in Radiology Journals

<table>
<thead>
<tr>
<th>Type of Article</th>
<th>No. of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original article</td>
<td>69</td>
</tr>
<tr>
<td>Clinical</td>
<td>57</td>
</tr>
<tr>
<td>Basic</td>
<td>8</td>
</tr>
<tr>
<td>Animal</td>
<td>2</td>
</tr>
<tr>
<td>Mixed</td>
<td>2</td>
</tr>
<tr>
<td>Review article</td>
<td>12</td>
</tr>
<tr>
<td>Technical report</td>
<td>10</td>
</tr>
<tr>
<td>Methodologic study</td>
<td>7</td>
</tr>
<tr>
<td>Guideline</td>
<td>1</td>
</tr>
<tr>
<td>Case report</td>
<td>1</td>
</tr>
<tr>
<td>Pictorial essay</td>
<td>0</td>
</tr>
<tr>
<td>Meta-analysis</td>
<td>0</td>
</tr>
<tr>
<td>Editorial</td>
<td>0</td>
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</tbody>
</table>

### TABLE 8: Subspecialties Represented in the 100 Top-Cited Articles in Radiology Journals

<table>
<thead>
<tr>
<th>Subspecialty</th>
<th>No. of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interventional radiology</td>
<td>19</td>
</tr>
<tr>
<td>Neuroradiology</td>
<td>15</td>
</tr>
<tr>
<td>Breast imaging</td>
<td>11</td>
</tr>
<tr>
<td>Chest imaging</td>
<td>7</td>
</tr>
<tr>
<td>Physics</td>
<td>7</td>
</tr>
<tr>
<td>Musculoskeletal imaging&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6</td>
</tr>
<tr>
<td>Radiation oncology</td>
<td>6</td>
</tr>
<tr>
<td>Cardiac imaging</td>
<td>4</td>
</tr>
<tr>
<td>Abdominal imaging</td>
<td>4</td>
</tr>
<tr>
<td>Vascular imaging</td>
<td>4</td>
</tr>
<tr>
<td>Pediatric imaging</td>
<td>2</td>
</tr>
<tr>
<td>Genitourinary imaging</td>
<td>0</td>
</tr>
<tr>
<td>Head and neck imaging</td>
<td>0</td>
</tr>
<tr>
<td>Miscellaneous&lt;sup&gt;b&lt;/sup&gt;</td>
<td>15</td>
</tr>
</tbody>
</table>

<sup>a</sup>Including the spine.<br><sup>b</sup>Not conforming to one of the categories listed.

### TABLE 9: Main Topics Covered in the 100 Top-Cited Articles in Radiology Journals

<table>
<thead>
<tr>
<th>Topic</th>
<th>No. of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiofrequency ablation of hepatic tumors</td>
<td>9</td>
</tr>
<tr>
<td>Receiver operating characteristic curve</td>
<td>6</td>
</tr>
<tr>
<td>MRI of the breast</td>
<td>4</td>
</tr>
<tr>
<td>Imaging findings of pulmonary embolism</td>
<td>3</td>
</tr>
<tr>
<td>MRI using superparamagnetic iron oxide contrast material</td>
<td>3</td>
</tr>
<tr>
<td>MRI of the heart</td>
<td>3</td>
</tr>
<tr>
<td>Screening mammography for breast cancer</td>
<td>2</td>
</tr>
<tr>
<td>Diffusion tensor MRI of the breast</td>
<td>2</td>
</tr>
<tr>
<td>MRI in stroke</td>
<td>2</td>
</tr>
<tr>
<td>MR angiography of the abdominal aorta</td>
<td>2</td>
</tr>
<tr>
<td>Vertebroplasty</td>
<td>2</td>
</tr>
</tbody>
</table>
Citation Classics in Radiology Journals

**TABLE 10: Radiologic Techniques Used in the 100 Top-Cited Articles in Radiology Journals**

<table>
<thead>
<tr>
<th>Radiologic Technique</th>
<th>No. of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRI</td>
<td>26</td>
</tr>
<tr>
<td>Interventional technique</td>
<td>15</td>
</tr>
<tr>
<td>CT</td>
<td>7</td>
</tr>
<tr>
<td>Conventional radiography</td>
<td>5</td>
</tr>
<tr>
<td>Angiography</td>
<td>5</td>
</tr>
<tr>
<td>Sonography</td>
<td>4</td>
</tr>
<tr>
<td>Nuclear medicine</td>
<td>4</td>
</tr>
<tr>
<td>Mammography</td>
<td>3</td>
</tr>
<tr>
<td>Mixed(^a)</td>
<td>12</td>
</tr>
<tr>
<td>Others(^b)</td>
<td>19</td>
</tr>
</tbody>
</table>

\(^a\)More than one radiologic technique used.
\(^b\)Not conforming to one of the categories listed.

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**FOR YOUR INFORMATION**

Mark your calendar for the following ARRS annual meetings:
- May 4–9, 2014—Manchester Grand Hyatt San Diego, San Diego, CA
- April 19–24, 2015—Toronto Convention Centre, Toronto, ON, Canada
- April 17–22, 2016—Los Angeles Convention Center, Los Angeles, CA