

Presentation of Original Research at the European Congress of Radiology 2010: Frequency of Publication in Medline-Indexed Journals Within 5 Years After Presentation

Präsentation wissenschaftlicher Originalarbeiten auf dem Europäischen Röntgenkongress 2010: Veröffentlichungshäufigkeit in Medline-indexed Zeitschriften innerhalb von 5 Jahren nach Präsentation

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ZUSAMMENFASSUNG

Hintergrund Bestimmung der Häufigkeit, mit welcher mündlich vorgetragene wissenschaftliche Originalarbeiten des Europäischen Röntgenkongresses (ECR) 2010 in Medline-gelisteten Zeitschriften veröffentlicht wurden sowie Erhebung entsprechender prädiktiver Faktoren.

Methode Insgesamt wurden 869 Abstracts in die Studie eingeschlossen. Alle im Programmheft des ECR 2010 aufgeführten wissenschaftlichen Abstracts wurden auf eine mögliche nachfolgende Veröffentlichung im Zeitraum März 2010 bis Februar 2015 hin ausgewertet. Hierzu erfolgte eine Medline-basierte Suche unter Zuhilfenahme der Erst-, Zweit- und/oder Letztautoren der jeweiligen Abstracts im ECR-Programmheft. Das Veröffentlichungsjahr, die Zeitschrift, das Ursprungsland, das Teilgebiet und die Art der wissenschaftlichen Arbeit (d. h. Patienten-/Probandenstudie, tierexperimentelle Studie oder methodisch-technische Studie) wurden aufgezeichnet.

Ergebnisse Im Zeitraum März 2010 bis Februar 2015 wurden insgesamt 450 Abstracts (Veröffentlichungsrate, 51,8%) in 125 Medline gelisteten Zeitschriften veröffentlicht, vornehmlich im European Radiology (11,1%). In 443/450 (98,4%) Fällen wurde die Arbeit auf Englisch veröffentlicht. Studien aus den Teilgebieten molekularer bzw. kardialer Bildgebung hatten die höchsten (75,0% bzw. 62,0%), Studien aus dem Gebiet der Computeranwendungen die niedrigsten (27,6%) Veröffentlichungsraten. Die Art der wissenschaftlichen Arbeit, das Ursprungsland des Abstracts sowie das Teilgebiet beeinflussten die Veröffentlichungsrate signifikant.

Schlussfolgerung Über die Hälfte der mündlich auf dem ECR 2010 präsentierten wissenschaftlichen Originalarbeiten wurden nachfolgend in Medline-gelisteten Zeitschriften veröffentlicht. Es wurden mehr Artikel in der Zeitschrift European Radiology veröffentlicht als in einem anderen identifiziertem Journal.

Kernaussagen:

- Der ECR 2010 hatte eine hohe nachfolgende Veröffentlichungsrate
- Die meisten nachfolgend veröffentlichten Artikel wurden in radiologischen Fachzeitschriften veröffentlicht
- Nahezu alle Artikel wurden in englischer Sprache veröffentlicht

ABSTRACT

Objectives To determine the rate at which original studies presented orally at the European Congress of Radiology (ECR) 2010 were published in Medline-indexed journals and to identify factors predictive of publication.

Methods A total of 869 abstracts were included in the study. A Medline search of articles published between March 2010 and February 2015 was conducted to identify articles written by the first, second, and/or last authors of all abstracts published in the Scientific Program of ECR 2010. The publication year, journal, country of origin, subspecialty and nature of the research (i. e., human, animal or technical) were recorded.

Results Between March 2010 and February 2015 a total of 450 abstracts (publication rate, 51.8%) were subsequently published in 125 Medline-indexed journals, chiefly in European Radiology (11.1%). 443/450 (98.4%) articles were published in English language. The subspecialties of molecular imaging and cardiac imaging had the highest publication rates (75.0% and 62.0%, respectively), while computer appli-

cation studies had the lowest (27.6%). The nature of research, origin of the abstract and subspecialty significantly influenced the subsequent publication rate.

Conclusion More than half of the original studies presented orally at ECR 2010 were subsequently published in Medline-indexed journals. More articles were published in the journal European Radiology than in any other identified journal.

Key Points:

- ECR 2010 had a high subsequent publication rate
- Most subsequently published articles were published in radiology journals
- Nearly all articles were published in the English language

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Introduction

National and international scientific conferences are important platforms where original research data are presented and discussed. These meetings have the advantages of rapid communication, immediate exchange of experiences and the opportunity to interact directly with other researchers. The next step in bringing research data to the scientific community involves written publication in a scientific journal. In the field of radiology, publication rates range from 11% to 47% [1–5]. Sometimes high publication rates are an indicator of the scientific level of a congress [2]. However, previously published studies have shown that publication rates depend on different factors, which are partly independent of the quality of research [6].

In Europe, the most relevant European congress to present original research data in the field of radiology is the European Congress of Radiology (ECR), which is held annually in Vienna. In 2010, this congress included more than 19 000 delegates from 96 countries, with nearly 12 000 professional medical delegates among them [7]. A preliminary study published by Loughborough et al. evaluated selected data from scientific presentations at ECR 2010 in a follow-up of 4 years, 9 months [8].

Since the results of several studies have shown that the majority of articles are published within five years after the material is presented at a conference [9–12], the aim of this study was to determine the subsequent publication rate in Medline-indexed journals from presentations at ECR 2010 in a follow-up of 5 years. Moreover, the study evaluated the publication year, language of publication, relationship to country of origin of abstracts, radiologic subspecialty, journal, concordance of the order of the first author and the study sample size in the abstract compared to those of the derived article.

Materials and Methods

Original research studies

One reader identified all ECR 2010 orally presented original studies by studying the final program abstract book [13]. The 869 identified abstracts were classified according to the following:

- a) the radiologic subspecialty as indicated in the program book;
- b) the country from which the abstract was submitted, as indicated in the program book (additionally classified as Europe, USA or other countries). The definition of Europe included the 27 countries of the European Union as of 2010 plus Bosnia-Herzegovina, Belarus, Croatia, Macedonia, Moldavia, Norway, Switzerland, Turkey and the Ukraine;
- c) the study subjects and materials involved patients and/or healthy volunteers, animals or methodological and technical materials. Abstract subjects and material were classified as patients and/or healthy volunteers if the abstract contained both human and animal or methodological and technical data, as animals if it contained both animal and methodological and technical data but no human data and as methodological and technical materials if it contained neither human nor animal data.

Study search and data collection

The subsequent publication rate for the corresponding studies was identified by scanning Medline on the PubMed server (www.ncbi.nlm.nih.gov/PubMed/) for the five-year period following the ECR 2010 Scientific Assembly, defined as March 2010 to February 2015. The first year after ECR 2010 was defined as the time interval between March 2010 and February 2011. The second year after ECR 2010 was defined as the period between March 2011 and February 2012, and so on. Abstracts that were withdrawn were excluded from the study.

A Medline search was performed by using the first initial(s) and the full family name of the leading author. If this search failed, the same procedure was conducted for the second author and – if it failed again – for the last author. If the search revealed more than 20 references, an appropriate keyword from the title of the abstract was added before the search was repeated.

Only original articles corresponding to the abstract were selected; letters, reviews and editorials were excluded. Moreover, articles published before March 2010, those with related abstracts presented at the congress and articles in which the number of described study subjects, animals or experiments was more than three times that cited in the abstract were excluded. These criteria were established because such abstracts likely corresponded to very preliminary work that was followed up in a major study bearing little resemblance to the initial protocol.

The concordance between the information contained in the summary of the published article and that cited in the abstract of the oral presentation was verified.

The following variables were assessed:

- the year of publication;
- the language of the published article;
- the journal of the published article (classified as radiology and non-radiology journals; radiology journals were considered to be all those included in the subject listing "diagnostic imaging", "radiology", "magnetic resonance" and "computed tomography");
- the position of the first author in the abstract in comparison to the position in the published article;
- the size of the study sample, considered as the number of patients, volunteers, animals or methodological and technical materials (classified as lower, similar or higher than those of the oral presentation);
- publication rates from countries with ten or more derived articles published from the abstract presentations;
- the radiologic subspecialty.

Data are presented as absolute numbers and relative frequencies. Publication rates between different factors were compared using Pearson's chi-squared test. A p-value < 0.05 was considered statistically significant. All analyses were performed using SPSS 24.0 (SPSS Inc., Chicago, IL, USA).

Results

Subspecialties, countries, and subjects

The 869 abstracts focused on the following 18 radiologic subspecialties, in decreasing order of frequency: interventional radiology (90/869, 10.4%), neuro (80/869, 9.2%), abdominal viscera (solid organs) (79/869, 9.1%), musculoskeletal (79/869, 9.1%), cardiac (79/869, 9.1%), chest (60/869, 6.9%), breast (59/869, 6.8%), gastrointestinal tract (58/869, 6.7%), vascular (50/869, 5.8%), genitourinary (49/869, 5.6%), abdomen (40/869, 4.6%), physics in radiology (39/869, 4.5%), pediatric (30/869, 3.5%), computer applications (29/869, 3.3%), head and neck (29/869, 3.3%),

molecular imaging (20/869, 2.3%), radiographers (20/869, 2.3%) and contrast media (19/869, 2.2%) (► Fig. 1).

The abstracts originated from a total of 41 countries, as indicated in the program book: 78.0% from European countries (678/869), 4.0% from the United States (35/869) and 18.0% from other countries (156/869). 10 or more abstracts originated from each of the following 15 countries: Germany (236/869, 27.2%), Italy (138/869, 15.9%), China (54/869, 6.2%), The Netherlands (49/869, 5.6%), Korea (42/869, 4.8%), Switzerland (41/869, 4.7%), France (39/869, 4.5%), United Kingdom (37/869, 4.3%), Austria (37/869, 4.3%), United States (35/869, 4.0%), Japan (20/869, 2.3%), Greece (16/869, 1.8%), Spain (16/869, 1.8%), Poland (10/869, 1.2%) and India (10/869, 1.2%) (► Table 1). The other 89/869 abstracts (10.2%) originated from the remaining 26 countries.

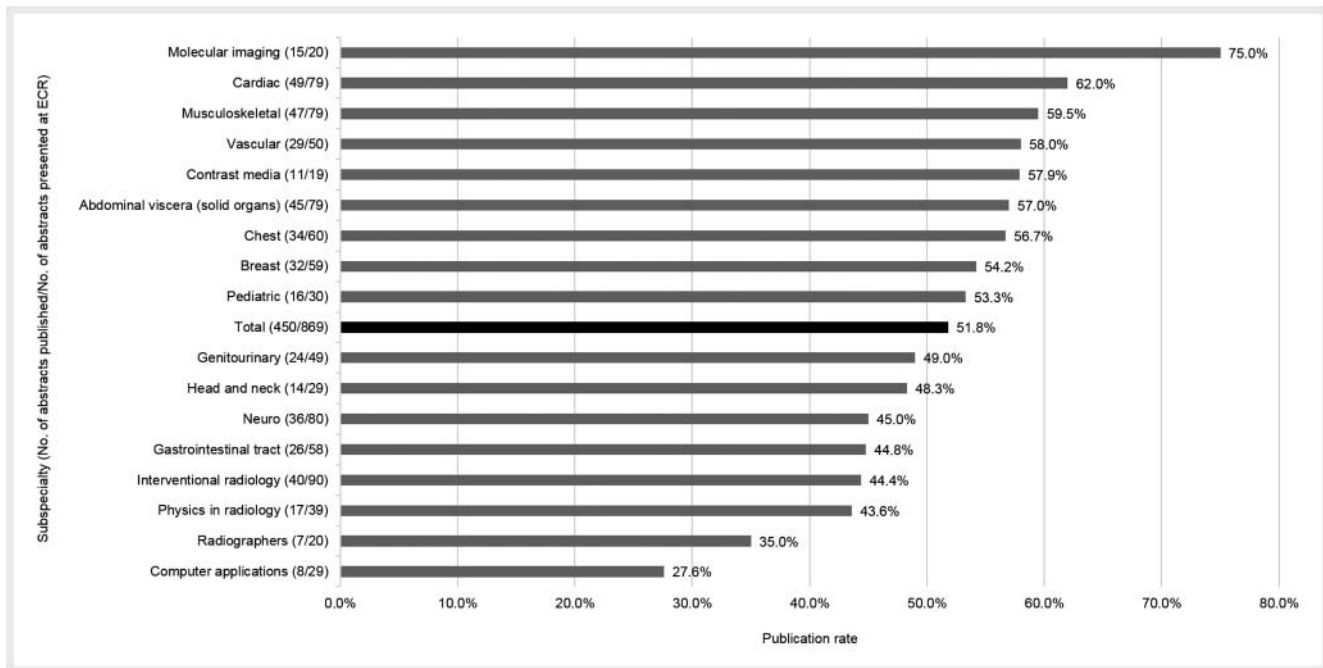
The abstracts referred to studies involving patients and/or healthy volunteers in 742/869 (85.4%) cases, studies involving animals in 45/869 (5.2%) cases and studies involving purely methodological and technical work in 82/869 (9.4%) cases.

Journals, languages and years in which articles were published

Between March 2010 and February 2015, 450 of the 869 abstracts presented at ECR 2010 were expanded into articles that were published in Medline-indexed journals, resulting in a publication rate of 51.8%. Concerning the year of publication, 134/450 (29.8%), 168/450 (37.3%), 91/450 (20.2%), 38/450 (8.4%) and 19/450 (4.2%) articles were published within the first, second, third, fourth and fifth year after ECR 2010, respectively. Thus, 87.3% (393/450) of these articles were published during the first three years after the 2010 scientific assembly.

The articles were published in a total of 125 journals, including, in decreasing order of frequency, European Radiology (50/450, 11.1%), European Journal of Radiology (48/450, 10.7%), Investigative Radiology (35/450, 7.8%), Radiology (29/450, 6.4%), American Journal of Roentgenology (21/450, 4.7%), Academic Radiology (17/450, 3.8%), American Journal of Neuroradiology (15/450, 3.3%), Journal of Magnetic Resonance Imaging (12/450, 2.7%), British Journal of Radiology (11/450, 2.4%), RöFo – Fortschritte auf dem Gebiet der Röntgenstrahlen und der bildgebenden Verfahren (11/450, 2.4%) and La Radiologica Medica (10/450, 2.2%). The other 191/450 (42.4%) articles were published in 114 journals (fewer than 10 articles published in each). Thus, more than half (259/450, 55.3%) of the articles were published in only 11 journals (10 or more articles published in each). 317/450 (70.4%) articles were published in radiology journals. 443/450 (98.4%) articles were published in English, 4/450 (0.9%) in German, 2/450 (0.4%) in Chinese and 1/450 (0.2%) in Spanish.

The size of the study sample was similar to that of the abstracts in 45.8% (206/450) of the articles, higher in 32.4% (146/450) and lower in 15.6% (70/450). In 6.2% (28/450), it was not possible to compare the study sample of the published paper and oral presentation because it was a phantom study or the exact sample size was not mentioned in one or both of the abstracts. Therefore, 48.0% (216/450) of papers had a different sample size than in the presentations at ECR 2010.



► **Fig. 1** Publication rates of orally presented original studies at European Congress of Radiology 2010 according to radiologic subspecialty as indicated in the program book. No., number. ECR, European Congress of Radiology.

► **Abb. 1** Veröffentlichungsrate mündlich vorgetragener wissenschaftlicher Originalarbeiten auf dem Europäischen Röntgenkongress 2010 bezogen auf die im Programmheft angegebene radiologische Subspezialisierung. No., Anzahl. ECR, Europäischer Röntgenkongress.

The first author in the abstract was listed as the first, second, third, fourth or later, or the last author or did not appear at all at the published article in 75.8% (341/450), 8.4% (38/450), 2.7% (12/450), 3.3% (15/450), 6.0% (27/450) and 3.8% (17/450) of cases, respectively.

Factors predictive of publication

Molecular imaging studies and cardiac imaging studies showed the highest publication rates: 75.0% (15/20) and 62.0% (49/79), respectively. Computer applications exhibited the lowest publication rate of 27.6% (8/29) (► **Fig. 1**). The subspecialty of the abstract significantly influenced the likelihood of subsequent publication ($p = 0.040$).

The publication rate depended on the country from which the abstract originated. Comparing the publication rate of the 10 countries with the most abstracts (more than 30 abstracts each from Germany, Italy, China, The Netherlands, Korea, Switzerland, France, United Kingdom, Austria, and United States), articles from these countries were more likely to be published than if they originated from the other 31 countries (390/708 (55.1%) vs. 60/161 (37.3%), respectively, $p < 0.001$). Furthermore, there was a significant difference ($p < 0.001$) in the publication rate among the top 10 countries (► **Table 1**).

Regarding the study subjects and materials involved, animal studies showed the highest publication rate at 57.8% (26/45), followed by studies including patients and/or healthy volunteers (53.0%, 393/742). Methodological and technical studies showed the lowest publication rate at 37.8% (31/82), $p = 0.024$.

Discussion

Of the 869 original studies presented orally at ECR 2010, 450 – or more than one-half – were subsequently published in Medline-indexed journals. The majority of the articles were published in English-language journals. Most of them were published in one journal, *European Radiology*. A total of 87.3% (393/450) of the articles were published within the first three years after ECR 2010.

Because the aim of the present study was to evaluate the rate of subsequent publication of orally presented abstracts, articles that were published before March 2010 were not considered. Because this study covered the five years after ECR 2010, i. e., March 2010 through February 2014, it is possible that single articles that were published after this date were missed. However, according to previously published studies, the mean time to publication after oral presentation at medical conferences is between 1 and 1.5 years [3, 9, 10]. Arrivé et al. [2] and Miguel-Dasit et al. [5] reported that 94% and 80% of articles were published within three years after the 1995 RSNA Scientific Assembly and ECR 2000, respectively. The results of the current study are in line with these reports: 87.3% of articles were published within three years after ECR 2010.

Published articles originating from ECR 2010 presentations were identified by searching for the authors' last names, a technique that has been described in several similar studies [2, 5]. However, the efficiency of this technique does not seem to have been evaluated until now. This search method entails the risk of missing a published article for reasons including major changes

► **Table 1** Publication rates according to country of origin, including countries that had at least ten oral presentations at European Congress of Radiology 2010. No., number.

► **Tab. 1** Veröffentlichungsrate in Bezug auf das Ursprungsland unter Berücksichtigung von Ländern, die mindestens 10 mündliche Präsentationen auf dem Europäischen Röntgenkongress 2010 hatten. No., Anzahl.

country of origin	no. of abstracts	no. of abstracts published	publication rate
Austria	37	18	48.6 %
China	54	17	31.5 %
France	39	26	66.7 %
Germany	236	138	58.5 %
Greece	16	8	50.0 %
India	10	0	0.0 %
Italy	138	63	45.7 %
Japan	20	12	60.0 %
Korea	42	27	64.3 %
The Netherlands	49	36	73.5 %
Poland	10	5	50.0 %
Spain	16	1	6.3 %
Switzerland	41	29	70.7 %
United Kingdom	37	19	51.4 %
United States	35	17	48.6 %

of the first author's name, misspelling of the first author's last name or that the name of the first author of the abstract was removed on the subsequent publication. According to Miguel-Dasit and colleagues [5], the first author of the oral presentation at ECR 2000 was not included as an author on the resulting full article in 7 % of cases and there was changed author position in 24 % of cases. This finding is consistent with the results of the current study, in which the first author of the abstract presented at ECR 2010 was absent or in a changed position in the subsequent full article in 3.8 % (17/450) and 20.4 % (92/450) of publications, respectively. To avoid or at least minimize the risks mentioned above of missing a published article, unsuccessful searches with the first author's name were repeated by using the last name of the second author and, if necessary, the last name of the last author. Consequently, the publication rate of 51.8 % of abstracts presented at ECR 2010 might be slightly lower than the actual publication rate. Alternatively, the subsequent publication rate could have been evaluated by a questionnaire-based survey of the authors in question. However, because ECR is the second-largest radiological meeting worldwide, this approach would have been extremely difficult.

Of the abstracts presented at ECR 2010, 78.0 % (678/869) originated from Europe, 4.0 % (35/869) from the United States and 18.0 % (156/869) from other countries. Out of the European

abstracts, Germany and Italy contributed the most, with approximately one-third (34.8 %, 236/678) and one-fifth (20.3 %, 138/678), respectively. These percentages are similar to those reported from ECR 2000, with 80.3 % of the abstracts originating from Europe, 2.1 % from the United States, and 17.5 % from other countries. At ECR 2000, the prevalence of Italian abstracts among the European abstracts (80.3 % of all abstracts) was 19.2 %, similar to the current results with 20.4 % (138/678). However, the proportion of German abstracts among European abstracts was slightly higher in 2000, with 41.8 % [5] compared to 34.8 % (236/678) in the current study.

The 51.8 % publication rate for articles from studies presented orally at ECR 2010 is similar to the publication rate reported after ECR 2000, with 47.0 % [5]. However, this rate is higher than that for the field of radiology in previously published articles ranging from 9 – 37 % [2 – 4, 14]. Regarding other medical disciplines, publication rates of abstracts orally presented at the respective meetings range from 44 % for abstracts presented at the meetings of four anesthesia societies [15] to 74 % for large randomized trials presented at annual meetings of the American Society of Clinical Oncology [16].

Whereas 83.9 % of the fully published articles related to oral presentations at ECR 2000 were published in English [5], this number rose to 98.6 % in the current study, highlighting the predominance of the English language in current medical research [17]. This finding is also emphasized by the fact that in the current study only 4/156 (2.6 %) fully published articles that were presented at ECR 2010 and originated from German-speaking countries (Austria and Germany) were published in the German language. The remaining 152/156 articles (97.4 %) were published in English. At ECR 2000, 27 % of the fully published articles that were presented at the scientific meeting and originated from German-speaking countries were published in German compared to 73 % in English [5].

It is possible that the radiologic subspecialty of the oral presentation might influence the publication rate. In the current study, the subspecialty of molecular imaging showed a rate of 75.0 % (15/20), the highest publication rate, followed by cardiac imaging studies, with 62.0 % (49/79). Meanwhile, computer applications showed the lowest publication rate, with 27.6 % (8/29). Considering that molecular imaging was not represented at ECR 2000, this ranking is similar to ECR 2000, with cardiac imaging studies having the highest and computer applications the lowest publication rates [5]. Finally, oral presentations of methodological and technical studies were expanded and published significantly less frequently than were oral presentations of patients and/or healthy volunteers or animal studies.

Among the 450 abstracts from ECR 2010 that were expanded into manuscripts, most articles were published in radiology journals (70.4 %), with European Radiology being the journal that published more articles than any other journal (11.1 %, 50/450). Similar proportions were found after ECR 2000, in that most articles were published in radiology journals (76.8 %) and European Radiology published more articles than any other journal [5].

Although subsequent publication of a study presented at a congress should be the aim of scientific work, nearly half of the abstracts (419/869, 48.2 %) presented at ECR 2010 were not pub-

lished as manuscripts. Previous published studies have evaluated the reasons for an abstract not being published. These included lack of time for writing the article, authors considering their results not important enough or doubting the acceptance of the manuscript, a negative study result, an ongoing study, difficulties with co-authors and low priority for submitting a manuscript [18, 19]. Obviously, publishing a manuscript in a scientific journal does not seem to be the goal of all medical researchers who present their results at scientific conferences. The authors of the current study presume that rejection of a manuscript might also play an important role in not publishing one's scientific work although, according to Weber et al. [18], rejection of a manuscript by a journal seems to be a minor factor related to not publishing in scientific journals. Among the oral presentations at scientific congresses that were not published, 80% were not submitted to a journal; only 20% of unpublished presentations were submitted to a journal [18].

There were several limitations to the present study. First, our method of identifying published articles may have led us to miss some published manuscripts. Our literature search was also restricted to journals indexed in Medline. Accordingly, it is possible that articles that were published in journals not indexed in Medline were missed. Moreover, only fully published papers within the first five years after ECR 2010 were considered, as the aim of the study was to evaluate the rate of subsequent publication of orally presented scientific work at ECR 2010. It is probable that single articles were missed because they were published before ECR 2010 or after the five-year interval we observed. Moreover, search errors cannot be excluded, e. g., misspelling the names of the authors. Major changes to author names present another risk of overlooking singular manuscripts. However, this risk was minimized by cross-searching the investigators. Finally, an abstract was considered published if the abstract and the proposed published manuscript had similar hypotheses and designs. If the information from the abstract was ultimately buried in another article, this abstract would not have been counted as published.

Conclusion

More than half of the original studies initially presented orally as abstracts at ECR 2010 were subsequently published in Medline-indexed journals. Articles were published within three years after the meeting in 87.3% of cases. More articles were published in *European Radiology* than in any other identified journal. The subspecialty of the abstract significantly influenced the likelihood of subsequent publication with molecular imaging and cardiac imaging studies showing the highest publication rates, and computer applications showing the lowest publication rates. Animal studies and studies including patients and/or healthy volunteers were more likely to be published than methodological and technical studies. Abstracts originating from the 10 countries with the most abstracts presented at ECR 2010 were more likely to be published than if they originated from the other 31 countries.

Despite the results presented in this study, the authors want to emphasize that, for the sake of scientific progress, scientists, potential authors, editors and organizers of scientific meetings

should not draw definite conclusions from the presented results. Altering scientific focus just for the purpose of enhanced publication probability might forego very important scientific findings. The low publication rates for certain areas can either be caused by the only marginal scientific impact of presented abstracts or by a lack of suitable journals.

CLINICAL RELEVANCE OF THE STUDY

- Rapid manuscript publication of congress abstracts indicates a good transfer of scientific knowledge from congresses to formal scientific publications in the field of radiology.
- This allows clinicians to get state-of-the-art scientific knowledge with clinical relevance not only at congresses but also in established scientific journals.
- The high propensity to publish scientific manuscripts in radiology journals indicates that radiologic journals cover most relevant research in this field.

Conflict of Interest

The authors declare that they have no conflict of interest.

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