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ORIGINAL STUDY

Do we publish what we present? The publication rate of a national arthroscopy society and a review of the literature

Jan Jaap De Graeff, Bauke W. Kooistra, Joris E.J. Bekkers, Frank W. Bloemers, Matthijs P. Somford, Max Reijman, Duncan E. Meuffels, Michel P.J. Van Den Bekerom

From the Scientific Committee of the Dutch Arthroscopy Society

The publication rate (PR) of full-text articles after presentation at medical society meetings varies widely. The purpose of this study is (1) to determine the PR of abstracts presented at the Dutch Arthroscopy Society's (NVA) annual meeting from 2006 until 2016, (2) to determine the time between presentation and publication, and (3) to review the known literature on the PR of orthopaedic scientific meetings. We retrospectively reviewed the programs of the NVA annual meetings from 2006 to 2016. All podium presentations reported were included. The search for subsequent journal publication was performed using PubMed, EMBASE, and Google Scholar databases. A systematic literature search was performed in PubMed. All studies regarding the publication rates of orthopaedic scientific meetings were included. From 2006 to 2016 a total of 131 papers were presented at the NVA annual meetings, of which 83 were published as full text articles (63%). The mean time to publication was 16.5 months. The overall PR at orthopaedic scientific meetings ranges from 21% to 71%.

Keywords : Publication rate ; NVA ; Dutch arthroscopy society.

INTRODUCTION

How much of what is presented at orthopaedic research societies is lost and will never be read

■ Jan Jaap De Graeff[1,7] (MD),
■ Bauke W. Kooistra[2] (MD, PhD),
■ Joris E.J. Bekkers[1] (MD, PhD),
■ Frank W. Bloemers[3] (MD, PhD, MSc),
■ Matthijs P. Somford[4] (MD, PhD),
■ Max Reijman[5] (MSc, PHD),
■ Duncan E. Meuffels[5] (MD, PhD),
■ Michel P.J. Van Den Bekerom[6,8] (MD, PhD)

[1]*Department of Orthopaedic Surgery, Diakonessenhuis Hospital, Bosboomstraat 1, 3582 KE, Utrecht, The Netherlands.*

[2]*Medische Kliniek Velsen, Leeghwaterweg 1B, 195 NA Velsen-Noord, The Netherlands.*

[3]*Department of Trauma Surgery, Amsterdam UMC, Vrije Universiteit Amsterdam, Boelelaan 1117, Amsterdam, The Netherlands.*

[4]*Department of Orthopaedic Surgery, Rijnstate Hospital, Wagnerlaan 55, 6815 AD, Arnhem, The Netherlands.*

[5]*Department of Orthopaedic Surgery, Erasmus MC, University Medical Centre Rotterdam, Doctor Molewaterplein 40, 3015 GD, Rotterdam, The Netherlands.*

[6]*Department of Orthopaedic Surgery, OLVG, Oosterpark 9, 1091 AC, Amsterdam, The Netherlands.*

[7]*Department of Orthopaedics, Leiden University Medical Centre, Leiden, The Netherlands.*

[8]*Department of Human Movement Sciences, Faculty of Behavioural and Movement Sciences, Vrije Universiteit Amsterdam, Amsterdam Movement Sciences, Amsterdam, The Netherlands.*

Correspondence : Jan Jaap de Graeff, MD, Department of Orthopaedic Surgery, Diakonessenhuis Hospital, Bosboomstraat 1, 3582 KE, Utrecht, The Netherlands. Phone : 0031882505000.

E-mail: jjdegraeff@gmail.com

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in the international peer reviewed orthopaedic literature? National and international meetings of medical societies provide researchers with a platform to present their latest findings or innovative novel techniques. Subsequent publication of the presented work in a peer-reviewed journal is the pursued outcome. The publication rate (PR) of full-text articles after presentation at medical society meetings may represent the scientific quality of these meetings. However the PRs vary widely (15-90%) *(1,2).* Even though much of the presented research does not progress to full-text publication (FTP), 53% to 63% of the chapters of orthopaedic textbooks referred to at least one unpublished abstract presented at an international meeting *(1).*

Several factors, such as a lack of time or co-author support have been indicated to explain the variation and the sometimes low PR of presented research *(3-6).* Abstracts from university-hospital affiliated institutions, with statistically significant results, experimental-based study designs and a large sample size have demonstrated a higher PR. In recent years, the interest in a meeting's or a society's PR has risen, as it represents an indicator of the degree and quality of the scientific society's activity and has become a tool for determining the scientific level of the research meeting.

The purpose of this study is (1) to determine the proportion of abstracts presented at a Dutch Arthroscopy Society's (NVA) annual meeting from 2006 until 2016 progressed to full-text publication in a peer-reviewed medical journal, (2) to determine the time between presentation and publication, and (3) to review the known literature on the PR of orthopaedic scientific meetings.

We hypothesized that the due to specific scientific niche of arthroscopic research within the field of orthopaedic surgery, the PR of abstracts presented at the NVA annual meeting would at least be equal to those of other orthopaedic meetings.

METHODS

The NVA organized their first scientific annual meeting in November 1990, which has become a yearly gathering since. We retrospectively reviewed the programs of the NVA annual meetings from 2006 to 2016. All abstracts of the podium presentations reported were included. The search for subsequent journal publication was performed in October 2018 using PubMed (Medline), EMBASE, and Google Scholar databases. This allowed for a minimal follow-up of 24 months for full-text publication of the presented abstracts. We are confident that this allowed us to find most, if not all, subsequent full-text publications of the presented abstracts, as a recent Cochrane Review reported a mean time of 18.4 months from presentation to publication *(7).* Also, a mean of 1.5 years has been reported of full-text publication delay after presentation of an abstract at an orthopaedic society meeting *(1).* Searches were conducted by author name and the first broad keyword appearing in the title. If not successful, this was followed by a search of the subsequent authors using the same search format. All authors' names were searched before declaring an abstract unpublished. This method of database review has been reported in prior studies *(1,8-11).* Published papers that were similar (i.e. similar hypothesis, study design, protocol, number of specimens, and results) to presented abstracts were included as a match. In addition, papers that contained the data presented, but also included additional data, were regarded as a match. These criteria have been used in prior studies *(7,8,12).* Time to publication was rounded to the nearest month. If a paper was published before the date of the annual meeting, the time to publication was noted as zero months. In case of full-text publication, the date of publication, the journal and the Journal Impact Factor (JIF) of the year of publication were recorded. JIFs were collected from Thomson Reuters Journal Citation Reports *(13).* The JIF is calculated by the following equation $JIF_y = (citations_{y-1} + citations_{y-2}) / (publications_{y-1} + publications_{y-2})$. If a journal did not have a JIF, it was given a JIF of zero.

On October 5th, 2018, a systematic search was performed in PubMed using the following search : publication[TIAB] AND (orthopaedic*[TIAB] OR orthopedic*[TIAB]). All studies regarding the publication rates of orthopaedic scientific meetings were included. Only studies written in English or Dutch were included. If the data from a study was completely covered by another study, the

study with the largest dataset was included. If no full-text was available, the study was excluded. Collected data included : the scientific meeting, the year of the scientific meeting, the number of abstracts presented, the number of abstracts that progressed to full-text publication, the overall PR of the abstracts presented, the minimal follow-up (months), the mean time to full-text publication (months), and if mentioned the podium presentation PR and the poster presentation PR. Reference lists of all included articles were screened for additional eligible articles.

For the statistical analysis IBM SPSS Statistics 24 was used. Because the data is categorical, binary, and unpaired a Chi Square test was used for testing relationships between variables.

RESULTS

From 2006 to 2016 a total of 131 papers were presented at the NVA annual meetings, of which 83 (63%) were published as full-text articles. Table 1 shows the PR, the mean JIF at time of publication, and the mean time to publication per year. Mean time to publication was 16.5 months (SD 15.5) ; 14 abstracts had been published prior to being presented at the annual meeting.

Thirty-four (n = 45) percent of the first authors were affiliated with a university hospital, 83 (63%) were not affiliated with a university hospital, and for three first authors it was not recorded. First authors with a university affiliation were four times more likely to proceed to full-text publication than authors without a university affiliation (74% vs. 43%, $p < 0.05$). The most common topic of the presented studies was the knee (n = 53, 41%), followed by the shoulder (n = 24, 18%). Table 2 shows a breakdown of the different topics and the percentage of publications.

Table 2. — Study topic

	Presented, n (%)		Published, n (%)	
Knee	53	(41)	30	(57)
Shoulder	24	(18)	14	(58)
Other *	16	(12)	11	(69)
Ankle	10	(8)	6	(60)
Hip	7	(5)	5	(71)
Elbow	6	(5)	6	(100)
Lower Leg	6	(5)	5	(80)
Wrist	3	(2)	3	(100)
Upper Leg	2	(2)	2	(100)
Upper Arm	3	(2)	1	(33)
Lower Arm	1	(1)	0	(0)

* Other includes : basic research, research related to the back or spine, research related to surgeon training.

Articles were published in 28 different journals, most frequently in Knee Surgery, Sports Traumatology, Arthroscopy (n = 22, 27%), the American Journal of Sports Medicine (n = 13, 18%), and Arthroscopy (n = 11, 13%). The mean JIF at time of publication was 3.0 (SD 1.2). Table 3 shows the breakdown of all full-text publications with respect to the journal and the range of JIF at publication.

A total of 504 studies were identified. After screening titles and abstracts 439 were excluded

Table 1. — Presentation and publication rate per year of the NVA annual meeting

Year	Presentations (n)	Publications (n)	Publication Rate (%)	Mean Impact Factor (SD) at publication		Mean time to publication in months (SD)	
2006	9	4	44.4	2.3	(0.9)	20.5	(9.8)
2007	9	5	55.6	1.8	(1.4)	16.6	(31.7)
2008	15	8	53.3	2.7	(1.2)	23.4	(14.4)
2009	11	7	63.6	3.0	(0.7)	17.3	(15.1)
2010	11	10	90.9	3.1	(1.1)	16.8	(13.1)
2011	4	2	50.0	3.2	(0.1)	36.0	(17.0)
2012	13	9	69.2	3.5	(1.3)	15.6	(18.0)
2013	17	14	82.4	3.2	(0.9)	16.1	(14.8)
2014	14	6	42.9	3.2	(0.7)	14.0	(16.5)
2015	23	16	69.6	2.9	(1.6)	13.2	(12.2)
2016	5	2	40.0	4.5	(1.8)	9.5	(6.4)
TOTAL	**131**	**83**	**63.4**	**3.0**	**(1.2)**	**16.8**	**(15.5)**

Table 3. — Journals in which presented abstracts at the NVA annual meeting were published

Journal	Publications (n)	Percentage of publications (%)	Impact Factor at publication (range)
Knee Surgery, Sports Traumatology, Arthroscopy	22	26.5	1.6 – 3.2
The American Journal of Sports Medicine	13	15.7	3.6 – 6.1
Arthroscopy	11	13.3	1.6 – 4.3
British Journal of Sports Medicine	8	9.6	2.2 – 6.7
Journal of Shoulder and Elbow Surgery	5	6.0	1.9 – 2.4
Acta Orthopaedica	3	3.6	1.3 – 2.2
Knee	2	2.4	1.5 – 1.9
Osteoarthritis and Cartilage	2	2.4	3.8 – 4.7
The Journal of Bone and Joint Surgery	2	2.4	3.2 – 4.3
Acta Orthopædica Belgica	1	1.2	0.4
Archives of Orthopaedic and Trauma Surgery	1	1.2	1.4
Arthroscopy Techniques	1	1.2	3.1
BMC Musculoskeletal Disorders	1	1.2	1.9
Chirurgie de la Main	1	1.2	0.3
Clinical Journal of Sport Medicine	1	1.2	2.1
Clinical Orthopaedics and Related Research	1	1.2	2.5
European Journal of Orthopaedic Surgery	1	1.2	0.2
Journal of the Mechanical Behaviour of Biomedical Materials	1	1.2	3.1
Nederlands Tijdschrift voor de Geneeskunde (NTvG)	1	1.2	-
Shoulder & Elbow	1	1.2	0.2
The Bone & Joint Journal	1	1.2	2.0
The Journal of Orthopaedic and Sports Physical Therapy	1	1.2	2.6
The Journal of Knee Surgery	1	1.2	2.1
Tissue Engineering Part A	1	1.2	4.5

due to the fact they did not concern orthopaedic scientific meetings, and 65 studies remained for full-text screening. After full-text screening three studies were excluded because all their data was completely represented in other studies, and 62 studies were included in a qualitative synthesis. These studies included 40 different orthopaedic scientific meetings. The overall PR at orthopaedic scientific meetings ranged from 21 to 71% ; the PR of podium presentations ranged from 20 to 90%, and the PR of poster presentations from 15 to 63% (Table 4) *(6, 8-12, 14-69).*

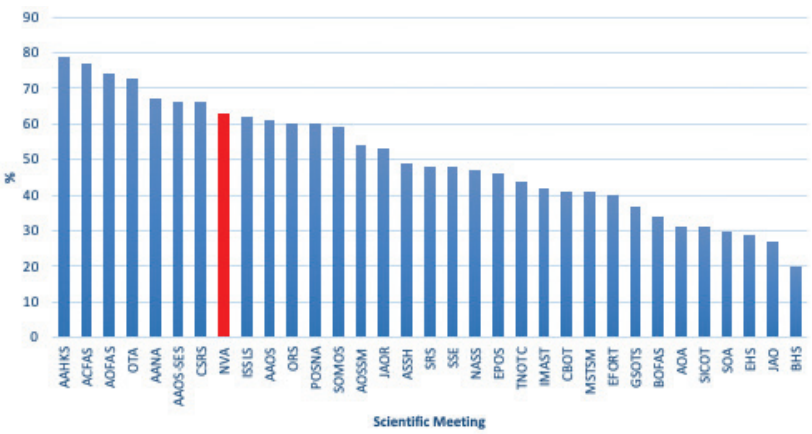

Figure 1. — Publication rate podium presentations

Figure 1 shows the most recent published podium presentation PRs of 31 orthopaedic scientific meetings, including the PR of the NVA annual meeting. The mean time to publication ranged from 4.9 months to 32.4 months, with a weighted average of 18.1 months.

DISCUSSION

We reviewed 131 scientific abstracts that were presented at the NVA annual meeting between 2006 and 2016 and found that 63% of these podium presentations progressed to full-text publication. This PR is among the highest reported for orthopaedic research meetings (figure 1). Our literature review shows that the overall PR at orthopaedic scientific meetings ranges from 21 to 71%, the PR of podium presentations ranges from 20 to 90%, and the PR of poster presentations from 15 to 63% (Table 4).

Previous studies examined the reasons for failure to convert presented abstracts into full-text journal publications and have tried to identify factors that may be associated with full-text publication following presentation. Abstracts submitted to scientific meetings typically undergo a peer review process before being accepted for podium or poster presentation. This review process is not as rigorous as the review process before publication in a peer-reviewed scientific journal, and abstracts may not contain all the information necessary for reviewers to assess their quality *(70).* Numerous studies show that podium presentations are more likely to be published as full-length manuscripts compared to poster presentations. In a study by Narain et al., 47% of the podium presentations were published in contrast with 38% of the poster presentations *(47)*. Frank et al. found a significant difference in the PR of abstracts accepted for podium presentations (59%) and poster presentations (44%) (P< .0001) *(25).* Similarly, in the study by Kinsella et al., who analysed the PR of abstracts presented at AOSSM annual meetings, podium presentations were more than 2 times more likely to be published than poster presentations *(9).*

Conflicting results have been reported with respect to an association between the level of evidence (LoE) and the PR of presentations at orthopaedic research meetings. Several studies have suggested that a higher LoE is positively associated with the PR of studies presented at meetings such as the European Paediatric Orthopaedic Society (EPOS) *(38)*, German Society of Orthopaedics and Trauma Surgery (DGOU) *(60)*, and American Association of Orthopaedic Surgeons (AAOS) annual meetings *(71).* Furthermore, Voleti et al. found an inverse relationship between LoE and average time to publication following presentation *(71).* However, other studies report no association between the LoE and full-text publication *(17,36,37,47).*

Sprague et al. conducted a survey among researchers who presented their research at the 1996 annual Meeting of the AAOS. Of the 199 respondents, 36% published their research, 16% submitted their research but it was rejected, and 36% never submitted their research for publication. The authors stated 3 main reasons for not submitting a manuscript to a peer-reviewed journal : (1) authors did not have enough time to prepare a manuscript for publication (the reason most frequently given, 46.5%) ; (2) almost one-third of the studies that had not been submitted for publication were ongoing ; and (3) relationships with co-authors sometimes delayed or prevented full-text publication *(6).* Their primary reason for failure to progress to full-text publication (lack of time) is consistent with other research *(3,4).*

A recent study by Collier et al. examined the PR of research presented in the largest hip and knee orthopaedic meetings in the United Kingdom (BHS and BASK annual meetings), and aimed to identify predictive factors which influence the PR. They found that progression to full-text publication was associated with positive rather than neutral outcomes (OR : 0.58 ; 95% CI : 0.37 to 0.74 ; p<0.01). Accordingly, abstracts had a 42% greater chance of being subsequently published if they presented significant results *(19).* Their findings are in line with other studies *(7,32,72).*

Similar to our cohort results, two studies showed that abstracts of which the first author is affiliated with university hospitals are more likely to progress to full-text publication *(73,74).* Collier et al. reported, that a greater methodological quality of a presented

Table 4. — Overview of the literature ; publication rate of orthopaedic scientific meetings

Scientific meeting	Year	Author	Total number of abstracts (n)	Overall PR* (%)	Podium PR* (%)	Poster PR* (%)	Minimal follow-up (months)	Mean Time to Publication (months)
AAHKS	1996-2001	Lloyd et al. [43]	292	-	58	-	48	21.7
	2011-2015	Naziri et al. [48]	957	60	79	52	12	-
	2012-2014	Bowers et al. [18]	610	71	90	63	-	14.5
AANA	1991-1993	Yoo et al. [68]	-	51	-	-	-	-
	2004-2012	Lehman et al. [42]	658	-	67	-	36	20
	2008-2012	Frank et al. [25]	976	49	59	44	36	14.4
	2011-2014	Baweja et al. [17]	290	-	67	-	36	12.2
AAOS	1990-1992	Hamlet et al. [12]	1465	46	-	-	48	20
	1993	Murrey et al. [46]	573	-	44	-	60	-
	1996	Sprague et al. [6]	465	-	36	-	72	17.6
	1999	Harris et al. [31]	318	55	-	-	60	-
	2001	Donegan et al. [22]	756	49	52	47	60	-
	2011-2015	Naziri et al. [48]	2129	56	61	51	12	-
AAOS-SES	1999-2004	DeMola et al. [8]	558	58	66	51	36	18
ACFAS	1999-2008	Abicht et al. [14]	825	-	-	24	36	17.6
	1999-2008	Roukis [56]	206	-	68	-	36	14.5
	2010-2014	Rushing et al. [57]	1221	28	77	23	36	17.6
AOA	1998	Harris et al. [32]	200	-	31	-	72	-
AOFAS	2008-2012	Williams et al. [11]	1262	62	74	56	48	17.3
AOSSM	1990-1993	Yoo et al. [68]	-	68	-	-	-	-
	1999-2001	Kleweno et al. [39]	165	-	59	-	60	21
	2006-2010	Kinsella et al. [9]	444	67	73	57	36	-
	2011-2015	Gowd et al. [29]	628	51	54	46	24	11.2
APTACSM	2000-2004	Warden et al. [65]	823	25	-	-	60	22.7
ASES	2005-2010	Kay et al. [36]	266	49	-	-	60	18.2
ASSH	1991-1992	Gavazza et al. [28]	397	-	52	-	36	-
	2000-2010	Theman et al. [10]	719	-	49	-	-	18
BASK	2002-2009	Mihok et al. [45]	602	33	-	-	48	23
	2007,2009,2010,2011	Collier et al. [19]	394	26	-	-	60	-
BHS	2004-2005	Whitehouse et al. [66]	163	-	20	-	38	4.9
	2006,2008,2009,2010	Collier et al. [19]	350	21	-	-	60	-
BOA	1997-1998	Guryel et al. [30]	300	35	-	-	-	16.2
	2001	Ul Haq et al. [62]	179	36	-	-	97	18.6
BOFAS	2009-2013	Marsland et al. [44]	341	32	34	29	20	19.1
CBOT	2007	Ejnisman et al. [24]	653	27	41	15	-	-
CSRS	2007-2011	Okafor et al. [53]	321	-	66	-	36	-
EFORT	1999. 2001	Kwong et al. [40]	278	-	40	-	-	-
EHS	2004-2005	Whitehouse et al. [66]	241	-	29	-	38	4.9
EPOS	2006-2008	Kleine-Konig et al. [38]	646	37	46	30	60	13.9
ESSKA	2008-2010	Kay et al. [37]	390	55	-	-	60	16
GSOTS	2003	Schulte et al. [60]	1100	36	37	32	48	15
IMAST	2009-2011	Frost et al. [26]	419	-	42	-	36	-
IOA	2002-2005	O'Neill et al. [50]	203	33	-	-	60	30.1
ISAKOS	1997-1999	Eck et al. [23]	358	37	-	-	51	-
ISSLS	1991-1993	Wang et al. [64]	335	45	-	-	48	-
	2010-2012	Ohtori et al. [52]	1126	50	62	47	60	-
JAO	2006-2007	Ohtori et al. [51]	1676	26	27	25	-	-
JAOR	2006-2008	Ohtori et al. [51]	1529	50	53	49	-	-
MSTSM	1991,1992,1995,1997-1999	Jasko et al. [35]	336	-	41	-	36	21.8
NASS	1990-1992	Wang et al. [64]	545	40	-	-	60	-
	2010-2012	Narain et al. [47]	1045	44	47	38	36	8.4
ORS	1991,1992,1993	Daluiski et al. [20]	890	-	52	-	48	18-23
	2012-2014	Hollenberg et al. [33]	1063	-	60	-	48	17

OTA	1990-1995	Nguyen et al. [49]	490	-	64	-	-	16
	1994-1998	Preston et al. [55]	815	-	67	52	72	-
	2005-2010	Lee et al. [41]	392	66	-	-	18	28.3
	2008-2012	Williams et al. [67]	357	-	73	-	48	23.4
POSNA	1991-1994	Jackson et al. [34]	349	-	53	-	-	29
	2002-2006	Amirhamzeh et al.[16]	762	51	-	-	48	29
	2003-2005	Varghese et al. [63]	440	59	60	57	48	20
SICOT	2009	Al-Hourani et al. [15]	329	-	31	-	60	23.4
SOA	2007, 2009-2013	Daruwalla et al. [21]	443	28	30	16	48	13
SOA (1)	2005-2011	Tait et al. [61]	568	41	-	-	-	19.2
SOMOS	1998-2006	Schoenfeld et al. [58]	770	46	-	-	36	32.4
	1999-2003	Fuller et al. [27]	435	44	-	-	-	-
	2009-2013	Orr et al. [54]	592	-	59	-	24	18.1
SRS	1991-1993	Wang et al. [64]	308	47	-	-	48	-
	2009-2011	Frost et al.[26]	345	-	48	-	-	-
SSE	2000-2003	Schulte et al. [59]	839	38	48	31	48	17.7
TNOTC	2007	Yalçınkaya et al. [69]	770	30	44	22	-	14.9

* PR : Publication Rate. For scientific meetings abbreviations, see list of abbreviations.

abstract is associated with full-text publication *(19)*. Juzuch et al. found that some abstracts were presented by students, residents, and research fellows, and suggested that this might be a group who has changing interests or insufficient time, preventing the production of a complete manuscript *(75)*.

Bhandari et al. noted rates of inconsistencies between the presented abstract and the final publication of the 1996 AAOS studies in terms of primary outcome measure and results, which differed 14% and 19% of the time, respectively. They also showed a decrease in sample size in 9% of studies *(1)*. Kleweno et al. showed an even higher rate of inconsistencies among presentations given at the 1999 to 2001 AOSSM meetings ; 63% of abstracts contained major inconsistencies compared with the final publication and 81% contained minor inconsistencies. Furthermore, the authors' interpretation of the data changed in 5% of abstracts, and in 2% the final full-text publication essentially invalidated the presented abstract *(39)*. Sprague et al. showed that the title was changed in 86% of the cases, and in 60% changes were made in authorship *(6)*. Although some inconsistencies might be part of an attempt to improve the quality and the chances of publication, some are likely a result of abstracts being based on preliminary data and, after additional data are collected, sample size, results, and conclusions need to be modified.

Limitations of our study are that the NVA annual meeting is a relatively small national orthopaedic research meeting with 131 abstracts presented over an eleven-year period. Due to our relatively small number of abstracts we did not do an analysis of the factors leading to the full-text publication of the presented abstracts, but instead chose to perform an extensive review of the existing literature.

Furthermore, the search for full-text publications of the presented abstracts was limited to PubMed (Medline), EMBASE, and Google Scholar databases, so we may have missed journal publications indexed in other databases. However, many previous studies regarding PR limited their searches to PubMed (Medline) and Google Scholar *(9,10, 16,22,25,67)*. So we are confident that we found most, if not all, full-text publications.

CONCLUSIONS

The full-text publication rate of 63% of the NVA annual meeting is one of the highest reported compared to other orthopaedic research meetings. Our literature review shows that the overall PR at orthopaedic scientific meetings ranges from 21 to 71% ; the PR of podium presentations ranges from 20 to 90%, and the PR of poster presentations from 15 to 63%.

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LIST OF ABBREVATIONS

AAHKS : American Academy of Hip and Knee Surgery, **AANA :** Arthroscopy Association of North America, **AAOS :** American Academy of Orthopaedic Surgeons, **ACFAS :** American College of Foot and Ankle Surgeons, **AOA :** Australian Orthopaedic Association, **AOFAS :** American Orthopaedic Foot & Ankle Society, **AOSSM :** American Orthopedic Society of Sports Medicine, **APTACSM :** American Physical Therapy Association's Combined Sections Meeting, **ASES :** American Shoulder and Elbow Surgeons, **ASSH :** American Society for Surgery of the Hand, **BASK :** British Association for Surgery of the Knee, **BHS :** British Hip Society, **BOA :** British Orthopaedic Association, **BOFAS :** British Foot and Ankle Society, **CBOT** : Brazilian Orthopedics Meeting (Annual meeting Brasileiro de Ortopedia), **CSRS :** Cervical Spine Research Society, **EFORT :** European Federation of National Associations of Orthopaedics and Traumatology, **EHS** : European Hip Society, **EPOS :** European Paediatric Orthopaedic Society, **ESSKA :** European Society of Sports Traumatology Knee Surgery and Arthroscopy,

FTB : full-text publication, **GSOTS :** German Society of Orthopaedics and Trauma Surgery, **IMAST :** International Meeting of Advanced Spinal Techniques, **IOA :** Irish Orthopaedic Association, **ISAKOS :** International Society of Arthroscopy, Knee Surgery & Orthopedic Sports Medicine, **ISSLS :** International Society for the Study of Lumbar Spine, **JAO :** Annual Meeting of the Japanese Orthopaedic Association, **JAOR :** Annual Research Meeting of the Japanese Orthopaedic Association, **JIF :** Journal Impact Factor, **LoE :** Level of Evidence, **MSTSM :** Musculoskeletal Tumor Society, **NASS :** North American Spine Society, **NVA :** Dutch Arthroscopy Society (Nederlandse Vereniging voor Arthroscopie) , **ORS :** Orthopaedic Research Society, **OTA :** Orthopaedic Trauma Association, **POSNA :** Pediatric Orthopaedic Society of North America, **PR : Publication Rate, SD : standard deviation, SICOT :** International Society of Orthopaedic Surgery and Traumatology (Société Internationale de Chirurgie Orthopédique et de Traumatologia), **SOA-USA :** Southern Orthopaedic Association – USA, **SOA :** Singapore Orthopaedic Association, **SOA(1)** : Southern Orthopaedic Association, **SOMOS** : Society of Military Orthopaedic Surgeons, **SRS** : Scoliosis Research Society Annual Meeting, **SSE** : Spine Society Europe, **TNOTC :** Turkish National Orthopaedics and Traumatology Annual meeting.