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Assessing the Readability in Medical Research Papers

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ABSTRACT

Background: The objective of this study was to investigate which medical specialties write the most readable articles and categorize what level of education that is required to understand the articles.

Methods: This study analyzed articles written by 38 medical specialties, represented by individual reports of 10 articles published after January 2021. The reports consisted of interventional studies from journals specific to each specialty identified by Journal Citation Reports, and a search string was developed and searched in PubMed. Characteristics such as the number of title characters, number of authors, and words in the introduction and discussion paragraphs were analyzed. Readability was measured by Lix score and Flesch Kincaid Grade Level. Subgroup analyses were conducted for popular vs. unpopular specialties, surgery vs. internal medicine vs. other specialties, and specialties with vs. without patient contact.

Results: A total of 379 articles were included. The introduction paragraph had a median Lix score of 68 and a Flesch Kincaid Grade Level of 17. The discussion paragraph had a median Lix score of 64 and a Flesch Kincaid Grade Level of 16. Specialties that were popular or with patient contact wrote articles that were more difficult to read than their counterparts, as did internal medicine compared with surgery and other specialties.

Conclusion: Readability was estimated as difficult across all medical specialties. Internal medicine wrote papers that were more difficult to read compared with surgery and other specialties. The same was applicable for specialties with patient contact and popular specialties compared with their counterparts. There is a need to make papers more readable across all specialties.

Keywords: education, research, readability, articles, doctor, convey

Introduction

In today's digital age, scientific articles are often shared on platforms such as Facebook, Twitter, YouTube, and blogs[1]. While these platforms are not typical for academic publications, they facilitate access to scientific information for both academia and laypeople. However, through time the complexity of scientific articles has increased due to long sentences, acronyms, difficult words, and complicated sentence structure even when a simpler sentence construction was possible[2], and the article is often tailored to a specialized audience with an understanding of the field. This complexity can make it harder for laypeople to understand the scientific articles.

One of the reasons a layperson might search for scientific articles is health-seeking behavior which is a normal attribute[3], especially when a patient receives a new diagnosis or when dealing with a long-term condition[3]. This attribute is a positive coping strategy due to becoming more involved in median decisions and the feeling of uncertainty when receiving a diagnosis[3]. Therefore, it would be beneficial if the layperson could understand the important conclusion of the scientific articles[3]. One possibility is to simplify the article another method is to include a layperson summary where the most important key points are addressed[4]. Another important point is the accessibility of scientific articles to the layperson, as many scientific articles are behind paywalls. This can be overcome if articles are published with open access, where the article does not require an access fee[5]. This benefits both the layperson and the researchers by providing transparency for the research[6] and enhancing the outreach[7].

The purpose of this article was to investigate which medical specialties write the most readable articles and to describe what level of education is required to read and understand academic papers.

Method

This was a retrospective study consisting of 10 published articles from each of the 38 medical specialties. Occupational and environmental medicine was grouped together with community medicine since there was an overlap in journals.

To be included in the study, the investigated reports had to concern an intervention trial and be published in a journal with a high impact factor specific to the given specialty. We included articles published after January 2021. If fewer than 10 articles were published from January onwards, articles published before January 2021 were also included until the investigated reports consisted of 10 articles related to the given specialty. Studies were excluded if they were published in general non-specialty-specific journals or in reviews.

The articles were identified through an individual search string searched in PubMed specific to each specialty and containing five specialty-specific journals. The journals were identified via Journal Citation Reports[8] using one of two following approaches: If Journal Citation Reports had a specific category for one of the 38 medical specialties, the five journals with the highest Impact Factor were selected. For broad categories in Journal Citation Reports such as surgery, which contains several surgical specialties, a search was made for specific words in the journal name that were associated with a given specialty such as a procedure or specialty name that did not contain "review" in the name. Journal Citation Reports were supplemented with the information portal Resurchify[9] if a specialty was not covered by the categories in Journal Citation Reports. Subsequently, PubMed's filters for time and study design were applied. The search string for family medicine was therefore: ("NPJ Prim Care Respir Med"[jour] OR "Eur J Gen Pract"[jour] OR "Am Fam Physician"[jour] OR "Ann Fam Med"[jour] OR "Br J Gen Pract"[jour]) Restriction: Randomized Controlled Trial and January 2021.

For the included articles, the following variables were extracted: number of authors, journal, specialty, number of words, and number of paragraphs in the introduction and discussion, as well as the number of references in the article's introduction. Our primary outcome was the readability of the articles in the introduction and discussion paragraphs, respectively, and this was analyzed using two different methods. One was the Lix score[10], which assesses the readability of a text by calculating the length of sentences and the number of words with more than six letters. A score between 0–24 is very easy to read, 25–43 is easy to read, 35–44 is standard text, 45–54 is difficult to read, and a score of 55 and above is very difficult to read. The second method was the Flesch-Kincaid Grade Level, which corresponds to the American level of education needed to understand the text[11,12]. A score of 5 means that the text is best understood if one has had 5 years of schooling. The higher the value, the harder the text is to read.

The secondary outcome was to analyze characteristics based on the given specialty. The numbers of the following parameters were compared: words and paragraphs for the introduction and discussion paragraphs of the articles, authors, characters in the title, and references in the introduction. In addition, three subgroups were compared in terms of the readability of the articles for different specializations. One comparison was between popular and less popular specialties. This was defined based on the maximum and minimum number of applicants in relation to advertised positions[13]. The popular specialties were neurosurgery, plastic surgery, gynecology and obstetrics, infectious medicine, and surgery. The less popular specialties were clinical immunology, child and adolescent psychiatry, vascular surgery, clinical pharmacology, and urology. Community medicine and occupational medicine were part of both subgroups and were therefore excluded from this analysis. The second subgroup analysis was between specialties with patient contact and specialties with no or little patient contact. Specialties assessed to have no or little patient contact included clinical pharmacology, clinical biochemistry, clinical physiology, and nuclear medicine, clinical immunology, clinical microbiology, and pathology. The remaining specialties were assessed as having patient contact. The final subgroup analysis involved comparing readability between surgical specialties, internal medicine specialties, and other specialties[14].

In this study, neither persons nor personally sensitive data were included, which is why permission was not sought from the Danish Data Protection Agency or the Regional Ethics Committee.

STATISTICAL METHOD

Data were analyzed in Excel 365 and Statistical Package for the Social Science (SPSS version 25.0.0.2, IBM, US) both collectively and separately for each of the 38 specializations. To assess whether continuous data were normally distributed for the individual specializations, Shapiro-Wilk's test was used[15]. Both normally distributed and non-normally distributed data were presented with median and range. Group differences were assessed with the Mann-Whitney U-test.

Results

A total of 379 articles were included, with 10 articles from each of the 38 specialties, except for clinical immunology, where only nine articles meeting the inclusion criteria were published. The articles were written by 1-49 authors (median 10) (Table 1). The longest introduction had 16 paragraphs (median 3), and an introduction consisted of 1,614 words (median 375 words), while other articles had an introduction with just one paragraph, and the shortest introduction consisted of 124 words. The number of references in the introduction varied from 4 to 19 (median 10). The median number of words in the discussion was 1,055 words (range 249-3,316 words) and it was divided into 2 to 20 paragraphs (median 8).

The readability was categorized as difficult across all specialties (379 articles). All articles had a Lix score of over 55 in both the introduction and discussion and were therefore considered difficult to read, except for a few articles that achieved a Lix score equivalent to standard text (Supplement Table 1). According to the Flesch-Kincaid Grade Level, all articles were at level 13 or above, equivalent to the reader having undergone 13 years of education to understand the articles (Table 1). Table 2 shows the readability of specialties based on their quartile placement, where pulmonology and neurology were the only specialties that were in the worst readability quartile across all categories (Lix score and Flesch-Kincaid Grade Level in introduction and discussion). When each specialty was evaluated with the Lix score, both pulmonology and infectious medicine performed worst in the introduction with a median score of 74, while forensic medicine had the lowest Lix score of 62. Also in the discussion, pulmonology had the worst readability with a value of 73, while clinical pharmacology had the lowest score of 54 (see Supplement Table 1). When the specialties were evaluated on their Flesch-Kincaid Grade Level, the introductions in hematology were the hardest to read with a median level of 19, while clinical immunology, which performed best, had a median level of 14. For the discussions, it was hematology, infectious medicine, pulmonology, and occupational, environmental, and community medicine that performed the worst with a readability level of a median of 18, and the best with a median level of 13 consisted of vascular surgery and clinical pharmacology (see Supplement Table 1).

Table 1: The overall characteristics of the included articles across specialties. Continuous variables are described with median [range], and categorical variables with number (%). n: number.

Characteristics for included articles (n = 379)	
Characters in the title including spaces	135 [51–317]
Number of authors	10 [1–49]
Publication year	
2022	8 (2)
2021	330 (87)
2006–2020	41 (11)
Introduction	
Number of paragraphs	3 [1–16]
Number of words	375 [124–1,614]
Number of references	10 [4–19]
Lix score	68 [43–86]
Flesch-Kincaid Grade Level	17 [8–25]
Discussion	
Number of paragraphs	8 [2–20]
Number of words	1,055 [249–3,316]
Lix score	65 [43–81]
Flesch-Kincaid Grade Level	16 [7–22]

Table 2: Readability of the 38 specialties based on their Lix score and Flesch-Kincaid Grade Level. The specialties are arranged by quartiles, with the best quartile representing specialties with the most readable articles and the worst quartile representing specialties with the least readable articles.

	Introduction		**Discussion**	
	Lix score	**Flesch-Kincaid Grade Level**	**Lix score**	**Flesch-Kincaid Grade Level**
Best quartile	Emergency medicine Child and adolescent psychiatry vascular surgery Clinical pharmacology Clinical immunology Clinical oncology Orthopedic surgery Pathology Forensic medicine	Emergency medicine Child and adolescent psychiatry vascular surgery Clinical immunology Clinical oncology Ophthalmology Pathology Plastic surgery Forensic medicine	Emergency Medicine vascular Surgery Clinical Pharmacology Clinical Physiology and Nuclear Medicine Clinical Immunology Clinical Oncology Forensic Medicine Rheumatology Urology	Occupational, environmental, and social medicine Endocrinology Gynecology and Obstetrics Hematology Infectious medicine Clinical Microbiology Pulmonology Nephrology Neurology Psychiatry
Mid quartiles	Anesthesia Gastroenterology and Hepatology Gynecology and obstetrics Hematology Cardiology Surgery Clinical biochemistry Clinical physiology and nuclear medicine Clinical genetics Clinical Microbiology Nephrology Neurosurgery Ophthalmology Plastic surgery Psychiatry Pediatrics Radiology Rheumatology Thoracic surgery Urology	Family medicine Anesthesia Occupational, environmental, and community medicine Endocrinology Gastroenterology and Hepatology Geriatrics Gynecology and obstetrics Infectious medicine Cardiology Clinical biochemistry Clinical pharmacology Surgery Nephrology Neurosurgery Orthopedic surgery Psychiatry Pediatrics Rheumatology Thoracic surgery	Family medicine Anesthesia Child and Adolescent Psychiatry Dermatology Gastroenterology and Hepatology Geriatrics Cardiology Surgery Clinical Biochemistry Clinical Physiology and Nuclear Medicine Clinical Genetics Clinical Immunology Clinical Microbiology Clinical Oncology Nephrology Ophthalmology Orthopedic Surgery Pathology Plastic Surgery Pediatrics Radiology Rheumatology Thoracic Surgery Otorhinolaryngology	Family medicine Anesthesia Child and Adolescent Psychiatry Dermatology Gastroenterology and Hepatology Geriatrics Cardiology Surgery Clinical Biochemistry Clinical Genetics Clinical Oncology Ophthalmology Orthopedic surgery Pathology Plastic surgery Radiology Rheumatology Thoracic surgery
Worst quartile	Family medicine Occupational, Environmental, and Social Medicine Dermatology Endocrinology Geriatrics Infectious Medicine Pulmonology Neurology Otorhinolaryngology	Dermatology Hematology Clinical physiology and nuclear medicine Clinical genetics Clinical Microbiology Pulmonology Neurology Radiology Urology Otorhinolaryngology	Family medicine Occupational, Environmental, and Social Medicine Endocrinology Gynecology and Obstetrics Infectious Medicine Pulmonology Neurology Psychiatry Pediatrics	Emergency Medicine vascular Surgery Clinical Pharmacology Clinical Physiology and Nuclear Medicine Clinical Immunology Neurosurgery Forensic Medicine Urology Pediatrics Otorhinolaryngology

When the popular specialties were compared with the less popular specialties, there was a difference between the two groups in almost all readability analyses ($p < 0.001$) where the less popular specialties were more readable, except for the introduction analyzed with the Flesch-Kincaid Grade Level ($p=0.07$) (Table 3). Specialties with no or sparse patient contact wrote more readable introduction and discussion paragraphs compared with specialties with patient contact, when this was evaluated with the Lix score ($p<0.001$), while there was no difference when readability was evaluated by the Flesch-Kincaid Grade Level ($p>0.05$) (Table 3). When surgery, internal medicine, and other specialties were compared, internal medicine in general wrote articles that were harder to read than surgery and other specialties. Between surgery and other specialties, there was a statistical difference in the discussion paragraphs (Figure 1).

Table 3: Readability for subgroup analyses, where popular specialties were compared with less popular specialties and specialties with patient contact were compared to specialties with little or no patient contact, as well as the p-value for the Mann-Whitney U-test. The Lix score[10] of 55 or higher is considered very difficult to read, and the Flesch-Kincaid Grade Level[11] corresponds to the number of years of education needed to understand the article. The values provided are median values.

		Popular specialties	Less popular specialties	P-value	Patient contact	Little/no patient contact	P-value
Lix score							
	Introduction	70	65	<0.001	69	66	<0.001
	Discussion	65	58	<0.001	65	61	<0.001
Flesch Kincaid Grade Level							
	Introduction	17	16	0,07	17	17	0.82
	Discussion	16	14	<0.001	16	15	0.12

Figure 1: Box plot illustrating the Lix score[6] and Flesch-Kincaid Grade Level[7] for the subgroup's surgical specialties, internal medicine, and other specialties. Additionally, the significant differences are marked with the corresponding p-values. The dotted line in the Lix score marks the boundary between difficult to read (below the dotted line) and very difficult to read (above the dotted line). The Flesch-Kincaid Grade Level corresponds to the years of education needed to understand the articles.

Discussion

Scientific articles across medical specialties were difficult to read and best understood by people who had undergone many years of education. Popular specialties and specialties with patient contact wrote less readable articles than the less popular specialties and specialties without patient contact. Internal medicine wrote less readable articles compared with surgical and other specialties.

The median Lix readability score for the introduction and discussion paragraphs was 68 and 65 respectively, and the Flesch Kincaid Grade level was 17 and 16, respectively. Thus, the language used in the scientific articles was generally difficult to read and required 16–17 years of education to be understood. However, the specialties of clinical immunology, urology, clinical pharmacology, and clinical oncology were able to write an introduction/discussion paragraph that was scored as a standard text. This raises the question of whether the problem is the writing abilities or whether it is a conscious strategy to write in a difficult language so that only a selected group of people can read and understand the articles and benefit from them. To make their articles easier to read and understand, authors can use a medical writer, where a trained person in medical communication writes the scientific article. Medical writers typically try to simplify the language and reach a level that can be understood by readers from 6th to 8th grade (Flesch Kincaid Grade level of 8), a level not achieved by any of the articles included in this study[16]. A fear of the authors could be that they would lose the right to authorship if the articles were written by a medical writer. However, according to authorship criteria, this is prevented, if all authors critically review and approve the final manuscript[17]. Another solution could be dictation, where the article is not written, but dictated to a recording device and then transcribed, resulting in a readability that is significantly better than for the included studies[18]. Finally, a journal initiative involving patients in the peer review process would ensure that the article can be understood by laypeople, as is done in the journal Research Involvement and Engagement[19]. Another approach to aid readability is the incorporation of a plain language summary[20]. This has e.g. been implemented by Cochrane who publish comprehensive, methodological, and sometimes complex systematic reviews [21]. To aid authors, Cochrane has developed a plain language summary template[21]. This template effectively communicates the key questions and findings of the review in a manner accessible to patients, carers, and the public[21], avoiding technical jargon and employing straightforward language. The adoption of plain language summaries is a relatively new practice but is gaining momentum, having become a requirement under the European Union Clinical Trials[22] Regulation. This will be beneficial as a layperson will have a better understanding of current research areas.

The most popular medical specialties wrote articles that were more difficult to read compared with less popular specialties. Popular specialties may focus on publishing more articles due to the competition for residency, which may reduce the time spent on thoroughly understanding and editing the final article. Articles from internal medicine were statistically less readable compared with articles from a surgical specialty. However, both readability measures displayed similar difficulty, thus the statistically significant difference between the groups' readability is not considered relevant, as both groups of medical doctors would benefit from simplifying their articles.

The strengths of this study include the use of objective analysis tools to assess the readability of the included articles. Another strength was that all specialties were represented with their own articles, except for occupational, environmental, and community medicine, which were grouped together. Additionally, it was a strength that the investigated reports consisted of articles from multiple different journals with a high Impact Factor within the given specialty, and that only recently published articles were included, as we wanted to investigate current practice. However, there are also some weaknesses in this study, such as the small sample of investigated reports for each specialty, that data were extracted only once by a single person, and that the investigated reports consisted only of interventional studies. Additionally, the readability scores are not

specifically designed or validated for scientific articles, and they generally predict that such articles will have a high level of difficulty. However, the Flesch-Kincaid Grade Level has been employed in previous studies involving scientific literature[23–25], which is why we opted to use this particular measure."

Currently, there are no guidelines dictating the level of writing proficiency authors should aim for when writing their articles. Additionally, medical doctors are known to possess a certain degree of arrogance[26], and it may be suspected that some may prioritize appearing academic and knowledgeable over being easily understood. However, there are several benefits to conveying scientific articles to a broader audience, which are also recognized by the new bibliometric analyses known as Altmetrics[27]. Here, authors are not only evaluated based on the number of citations within the research community such as by their h-index or I-index. Altmetrics also includes a number of individuals who have read, discussed and downloaded an author's scientific article[27]. Thus, an easily understandable article that allows readers to engage and discuss it is likely to enhance the author's Altmetrics profile and maybe also the number of scientific citations.

Conclusion

In this study, 38 medical specialties were examined through 10 scientific articles per specialty. We found that the articles across specialties were very difficult to read and understanding required a long education. The most popular specialties, specialties with patient contact, and internal medicine wrote articles that were harder to read than their counterparts.

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Authors' contributions

Nadir Noureldin Abdella Bahta: acquisition, analysis, and interpretation of data, drafting the work, final approval, and agreement to be accountable for all aspects of the work.

Siv Fonnes: conception and design of the work, revising it critically, final approval, and agreement to be accountable for all aspects of the work

Jacob Rosenberg: conception and design of the work, revising it critically, final approval, and agreement to be accountable for all aspects of the work.

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Supplementary Table

Supplement Table 1: readability and characteristics of included medical specialties. The values are median from a cohort of 10 studies with the exception for Clinical immunology which had a cohort size of nine studies. Range: []; number: n

Medical specialties	Signs in title including space	Authors, n	Introduction paragraph of articles					Discussion paragraph of articles			
			Paragraphs, n	Words, n	References, n	Lix score[6]	Flesch-Kincaid Grade Level [7]	Paragraphs, n	Words, n	Lix score [6]	Flesch-Kincaid Grade Level [7]
Emergency medicine	134 [52–196]	10 [5–39]	3 [2–6]	294 [176–539]	11 [4–22]	65 [56–70]	16 [12–18]	8 [4–11]	950 [490–1331]	60 [52–67]	14 [11–18]
Family medicine	123 [102–140]	9 [3–19]	3 [2–5]	324 [163–440]	16 [5–22]	71 [60–80]	17 [14–21]	9 [5–16]	681 [501–1361]	67 [60–76]	16 [13–18]
Anesthesia	135 [73–197	9 [4–17]	4 [2– 5]	411 [239– 524]	18 [4– 29]	70 [63– 75]	17 [16– 21]	7 [4– 10]	1050 [650– 1468]	65 [58– 72]	15 [13– 20]
Occupational and community medicine	159 [107–230]	15 [5–22]	3 [2– 6]	386 [226– 777]	14 [8– 26]	72 [64– 80]	18 [15– 21]	8 [6– 12]	1240 [916– 1555]	71 [66– 75]	18 [17– 19]
Child and adolescent psychiatry	162 [83–215]	6 [3–12]	5 [4– 8]	738 [450– 1295]	23 [14– 54]	65 [58– 86]	16 [13– 20]	7 [5– 15]	1240 [916– 1555]	66 [58– 86]	16 [12– 20]
Dermatology	206 [99–267]	8 [5–11]	3 [2– 6]	294 [187– 720]	18 [5– 27]	71 [59– 75]	18 [13– 19]	8 [5– 13]	915 [765– 1352]	65 [59– 75]	16 [13– 19]
Endocrinology	166 [99–224]	13 [9–18]	4 [3– 6]	383 [225– 594]	12 [3– 34]	72 [61– 80]	17 [13– 21]	8 [6– 13]	1231 [566– 1825]	69 [58– 80]	17 [13– 20]
Gastroenterology and hepatology	126 [85–176]	17 [7–35]	4 [2– 5]	488 [220– 629]	24 [6– 29]	69 [58– 74]	18 [13– 20]	9 [5– 13]	1439 [798– 910]	66 [57– 70]	16 [12– 19]
Geriatrics	136 [96–161]	7 [3–28]	3 [1– 5]	290 [230– 538]	12 [8– 18]	71 [62– 79]	17 [15– 20]	7 [4– 9]	678 [435– 1602]	65 [55– 76]	16 [12– 19]
Gynecology and obstetrics	125 [82–162]	7 [3–11]	3 [2– 3]	286 [162– 408]	14 [7– 28]	69 [56– 78]	17 [9– 20]	7 [3– 11]	863 [539– 1553]	68 [63– 70]	17 [9– 18]
Hematology	129 [111–193]	19 [9–39]	4 [1– 7]	425[279– 847]	17 [6– 25]	68 [60– 80]	19 [14– 21]	7 [4– 10]	1011 [546– 1780]	66 [50– 71]	18 [12– 20]
Infectious medicine	184 [88–253]	18 [11–32]	4 [2– 7]	387 [237– 583]	19 [11– 25]	74 [56– 78]	18 [12– 22]	8 [7– 12]	1050 [788– 1708]	69 [57– 78]	18 [15– 22]
Cardiology	123 [80–166]	14 [9–23]	3 [1– 4]	345 [129– 903]	16 [5– 31]	70 [60– 80]	18 [14– 22]	9 [5– 12]	1241 [481– 1563]	66 [56– 76]	15 [14– 20]
Vascular surgery	131 [75–203]	9 [4–16]	3 [1– 6]	285 [146– 395]	12 [6– 23]	65 [52– 73]	15 [13– 18]	10 [5– 15]	1160 [478– 1901]	60 [53– 63]	13 [12– 16]
Surgery	147 [102–184]	8 [3–10]	4 [1– 9]	325 [234– 610]	16 [6– 30]	68 [64– 74]	17 [16– 21]	10 [2– 13]	926 [249– 1507]	63 [48– 69]	15 [12– 17]
Clinical biochemistry	128[97–217]	9 [2–12]	5 [3– 8]	515 [383– 1099]	12 [14– 41]	68 [63– 86]	18 [16– 25]	9 [5– 16]	1365 [875– 2240]	64 [54– 78]	16 [12– 22]
Clinical pharmacology	137 [98–186]	11 [2–23]	3 [1– 5]	334 [208– 566]	16 [8– 27]	63 [56– 75]	18 [14– 21]	8 [5– 13]	1149 [759– 1970]	54 [44– 62]	13 [10– 16]
Clinical physiology and nuclear medicine	138 [70–191]	11 [6–24]	5 [3– 6]	456 [190– 808]	24 [9– 32]	68 [59– 74]	18 [14– 19]	7 [4– 11]	1121 [645– 1491]	60 [47– 70]	15 [9– 18]
Clinical genetics	132 [107–214]	15[10–22]	4 [2– 6]	460 [295– 600]	20 [3– 25]	69 [59– 73]	18 [15– 20]	7 [5– 12]	1267 [797– 1861]	64 [57– 77]	16 [14– 21]
Clinical immunology	101 [86–145]	16 [13–35]	3 [2– 6]	465 [282– 749]	24 [11– 36]	63 [43– 75]	14 [8–21]	5 [4– 9]	944 [520– 1369]	58 [53– 75]	15 [12– 19]
Clinical microbiology	164 [134–186]	8 [5–25]	3 [1– 4]	297 [133– 511]	12 [4– 24]	69 [54– 76]	18 [15– 21]	8 [3– 10]	1027 [249– 1464]	65 [60– 71]	16 [14– 20]
Clinical oncology	162 [102–294]	20 [15–43]	3 [1– 5]	377 [140– 535]	15 [6– 29]	67 [45– 79]	16 [10– 21]	7 [5– 11]	909 [639– 1699]	57 [48– 78]	15 [12– 21]
Pulmonology	162 [30–209]	14 [6–24]	4 [2– 8]	363 [268– 677]	17 [8– 24]	74 [65– 80]	18 [17– 21]	8 [5– 14]	1399 [757– 1814]	73 [62– 76]	18 [9– 20]
Nephrology	141 [79–187]	12 [5–22]	4 [2–5]	502 [274–854]	18 [6–29]	68 [60–71]	17 [15–20]	8 [5–10]	1293 [822–1573]	66 [57–69]	16 [14–19]
Neurosurgery	124 [78–201]	8 [5–22]	3 [1–5]	292 [190–641]	13 [8–18]	70 [57–82]	17 [1–22]	9 [5–12]	935 [568–1124]	62 [53–71]	14 [7–17]
Neurology	147 [81–203]	16 [8–49]	3 [1–3]	349 [173–497]	14 [5–26]	72 [61–79]	18 [16–21]	8 [5–9]	1115 [688–1734]	70 [59–72]	17 [15–19]
Ophthalmology	133 [75–225]	8 [4–16]	5 [2–10]	473 [277–1032]	23 [14–37]	68 [58–80]	17 [16–21]	8 [4–11]	1092 [747–3316]	65 [58–81]	16 [13–22]
Orthopedic surgery	129 [85–234]	6 [3–8]	3 [2–16]	304 [187–463]	15 [7–31]	67 [58–83]	17 [14–23]	7 [4–12]	1016 [531–1516]	65 [54–72]	16 [12–18]
Pathology	106 [63–133]	9 [5–26]	4 [3–6]	507 [302–929]	14 [2–41]	66 [45–75]	16 [12–19]	9 [5–11]	1142 [870–2465]	63 [54–68]	16 [14–17]
Plastic surgery	140 [108–204]	6 [3–10]	4 [3–7]	348 [136–734]	16 [4–38]	69 [60–79]	16 [14–19]	10 [5–20]	1041 [553–1457]	64 [56–71]	16 [13–17]
Psychiatry	144 [107–164]	9 [3–16]	4 [3–16]	517 [379–1300]	22 [12–46]	68 [58–81]	17 [10–120]	7 [6–12]	1137 [543–1781]	68 [62–81]	16 [14–21]
Pediatrics	91 [70–149]	8 [1–13]	3 [1–7]	384 [124–587]	18 [14–36]	69 [61–82]	17 [14–20]	7 [3–11]	971 [440–1347]	67 [55–72]	15 [12–17]
Radiology	143 [114–238]	10 [6–21]	3 [1–5]	340 [140–756]	13 [9–36]	70 [63–80]	18 [15–21]	8 [5–9]	1041 [878–1186]	62 [55–68]	15 [13–18]
Forensic medicine	98 [59–174]	5 [2–9]	4 [1–15]	476 [162–1614]	18 [1–48]	63 [59–71]	15 [13–17]	9 [5–18]	1386 [672–2544]	59 [54–69]	14 [12–15]
Rheumatology	142 [105–246]	12 [5–34]	3 [3–4]	392 [172–548]	14 [8–21]	69 [62–81]	17 [15–20]	8 [5–12]	903 [608–1480]	61 [49–74]	16 [11–20]
Thoracic surgery	117 [87–150]	8 [3–11]	3 [1–5]	308 [241–428]	12 [6–17]	68 [56–86]	17 [12–20]	8 [6–11]	1075 [570–1337]	65 [55–74]	15 [13–18]
Urology	141 [51–317]	11 [6–27]	3 [1–5]	300 [210–439]	12 [5–16]	70 [52–80]	18 [13–21]	7 [5–11]	894 [635–1164]	59 [43–72]	14 [7–19]
Otorhinolaryngology	128 [82–176]	8 [4–10]	4 [1–10]	448 [161–846]	15 [4–37]	71 [63–86]	18 [14–24]	8 [6–10]	1012 [830–1553]	64 [57–80]	15 [13–22]