# Altmetrics of Papers From Scientific Periphery Reflect Global Trends: A Case Study of Publications by Zagreb University School of Medicine

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## Abstract

This study aims to investigate the altmetric activity of papers published by the University of Zagreb School of Medicine in internationally visible journals and to identify differences in altmetric activity between the papers published in international and local journals and between those published in English and Croatian. We also investigated changes in altmetric activity over time and the characteristics of papers with the highest Twitter and Mendeley activity.

The sample included 390 papers collected from the bibliographic database Scopus. Their altmetric and citation activities were measured at three time points: in July 2014, 2015, and 2016. The findings generally correspond to those observed in the large-scale studies of medical papers. Papers in renowned journals, and papers reporting clinical guidelines and multicentric studies had the most intense altmetric activity. In contrast, papers published in local, Croatian journals showed minimal altmetric activity, especially the papers published in Croatian. These results indicate that the local publishing community has not yet recognised social media as a tool for promoting research and that non-English language publications have minimal chances to receive attention, even in social media.

The evaluative potential of altmetric indicators has to be further explored in a broader context.

**Keywords:**

Altmetrics, Social media, Scientifically peripheral countries, University medical schools, Periodicals

## Introduction

New publishing platforms have brought changes in the models of scientific communication beyond the traditional journal as well as a variety of formats that accompany traditional scientific articles, such as sharing "raw science" in the form of datasets, semantic publishing, or "nanopublication" (Priem, Taraborelli, Groth, & Neylon, 2010). Many of these formats, including self-publishing via blogging, micro-blogging, and post-publication comments, are facilitated by social media technologies. Diverse audiences beyond the academy have emerged as well: practitioners, clinicians, and the general public (Lapinski, Piwowar, & Priem, 2013). These are the so called "pure" or non-publishing readers and practitioners who make use of research publications in their daily activities (Haustein et al., 2013). Moreover, open access has made scientific information more available to the general public, requiring from researchers to bring science to non-specialists (European commision, 2016).

The widespread use of social media in disseminating and discussing research publications calls for new ways of measuring the impact of individual authors and their publications (Priem et al., 2010). Haustein, Bowman, and Costas (2015) defined these metrics as "events on social and mainstream media platforms related to scholarly content or scholars, which can be easily harvested, and are not the same as the more 'traditional' concept of citations". Altmetrics measure any impact a publication or an author may have on other people (Bar-Ilan et al., 2012). They try to capture the activities that happen between viewing a paper and citing it (Fenner, 2014). By tracking shares, likes, comments, discussions, reviews, bookmarks, saves, tweets, and mentions of scientific publications and sources in social media (Wouters & Costas, 2012), altmetric tools capture the real-time impact of scientific outputs on the total reader population. Trueger et al. (2015) proposed to call it "a measure of disseminative impact".

Taylor (2013) found that research that delivers knowledge to practitioners is likely to have greater societal impact, but the usage patterns of research publications may vary, depending on the social, economic, legislative, and national status of individual research disciplines. For example, medicine is characterised by a significant share of practitioners in the total number of users of research information, great interest of general public in all kinds of medical information, and by a great proportion of OA publishing in the total number of new scientific publications (Laakso & Björk, 2012; Škorić, Vrkić, & Petrak, 2016). Social media offer health scientists numerous opportunities to disseminate their research transparently, increase the impact of their articles and reports, and engage with the public (Bjerglund Andersen &

Söderqvist, 2012). These may be some of the reasons why medical papers have such a discernible echo in social media. Medical authors working in small academic communities on the scientific periphery who are struggling for better visibility and impact could especially benefit from using social networks and other Web 2.0 tools. According to Hebrang Grgić (2014) "peripheral scientific communities are defined by either (or both) of two factors – language (other than English) and economy". Countries that do not spend much on research and do not have powerful publishing industry can be considered as peripheral countries. The journals from these countries rarely publishe reports on "breakthrough" research results that have a potential global influence (Sambunjak, 2006).

*Background*

The use of medical scholarly content in social media has been studied extensively. Haustein, Larivière, Thelwall, Amyot, and Peters (2014) have analysed how often Twitter is used to diffuse journal articles in biomedical and life sciences and examined the relationship between tweets and Web of Science (WoS) citations. They have found that Twitter has a much lower coverage of scholarly documents than other social media platforms, but that there are journals and specialties in biomedical sciences that are of great interest to the Twitter community. This in-depth analysis of highly tweeted documents has showed that while some papers seem to receive attention on Twitter because of actual health implications or topicality, others seem to be distributed on Twitter due to humorous or curious content, which suggests that tweets do not necessarily reflect scientific or professional impact. Low correlation between the number of citations and tweets per document indicates that tweets and citations are far from measuring the same impact.

Many authors have studied the correlation between altmetrics and citation metrics (Bornmann, 2015; Costas, Zahedi, & Wouters, 2015; Haustein & Larivière, 2014; Mohammadi & Thelwall, 2014; Mohammadi, Thelwall, Haustein, & Larivière, 2015; Thelwall & Kousha, 2015; Tonia, 2014; Zahedi, Costas, & Wouters, 2013, 2014a, 2014b). A study comparing 11 altmetric indicators (excluding Mendeley) with WoS citations (Thelwall, Haustein, Larivière, & Sugimoto, 2013) found that six were associated with citation counts, at least in medical and biological sciences. The authors reported that less than 20% of the papers were covered by most of social media resources.

Based on a sample of 1.2 million documents published in journals covering biomedical research, clinical medicine, health, and psychology indexed in PubMed and WoS, Haustein and Larivière (2014) analysed Mendeley as a source of usage statistics for scientific papers.

They reported that 66% of the analysed papers had at least one Mendeley reader and that the average number of readers per document was quite high compared to the uptake and average activity on other social media platforms. Even though reading and citing are not similar scientific activities, Li and Thelwall (2012) found positive correlations between the Mendeley readership counts and the traditional bibliometric indicators in a sample of genomics and genetics papers. Exploring different types of users in clinical medicine, engineering and technology, social science, physics, and chemistry research papers inside and outside academia, Mohammadi et al. (2015) found that clinical medicine articles had the highest coverage in Mendeley and that many of them were read by medical professionals. The authors refer to it as "plain reading" without a follow-up, such as citing or doing other research activities.

Some studies have highlighted the importance of using social media for health communication and public health surveillance. According to Bjerglund Andersen and Söderqvist (2012), community orientation, open two-way communication, flexibility, fast distribution, wide audience, and freeness are the key advantages of using social media in public health science communication. Its key weaknesses, on the other hand, are lack of control, vulnerability to misuse, and lack of formalised peer-review. Since social media are widely used by the public to discuss health issues, the authors emphasized that if the scientists' perspective is not present in social media, then other perspectives will prevail. Another topic of interest, especially to medical journals, has been the challenge social media present to the "traditional" metrics. Hoang, McCall, Dixon, Fitzgerald, and Gaillard (2015) emphasise that researchers in any medical specialty should not ignore the opportunities to increase their impact via social media, even though peer-reviewed publication remains the most widely accepted measure of academic productivity. The same is recommended to medical journal publishers: even though altmetric indicators do not directly tell about the quality or the impact of the paper, social media should be used by journals to increase their visibility (Scarlat, Mavrogenis, Pećina, & Niculescu, 2015).

Literature suggests that altmetrics can also generate many controversies. While some authors argue that they can be a good proxy for societal (Bornmann, 2014) and early scientific impact (Eysenbach, 2012), others argue that they reflect nothing but rumour, popularity, and superficiality (Coloquhoun & Plested, 2014). These objections, however, are also true of the traditional citation metrics; quantitative methods cannot and should not be used as a measure of quality, because they fail to consider the content of papers (Coloquhoun & Plested, 2014).

Evaluation of the research output on both individual and institutional level is becoming increasingly important today. It can be performed as a large-scale, multifaceted survey, conducted systematically and regularly, but it can also be occasional and fragmentary, with a specific purpose to serve as a decision-making instrument. Despite its limitations and shortcomings (Haustein & Larivière, 2015), citationbased metrics dominate among other criteria for academic promotion and tenure decisions in many institutions (Konkiel, Sugimoto, & Williams, 2016) and in other forms of academic decisionmaking (e.g. grant proposal evaluations, academic awards, etc.). On the other hand, alternative metrics have been subjected to close scrutiny in the academic setting (Sud & Thelwall, 2014; Sugimoto, 2015). Fenner (2014) argues that many questions have to be answered before using altmetric indicators for research evaluation, two of them in particular: how to standardise altmetric indicators and how to interpret the results in the context of scholarly impact.

Every academic setting influences academic and research performance in its own way, and uses its own methods of evaluation, often anchored in local circumstances. When the academic setting is small and on scientific periphery, this evaluation can be very delicate and require certain precautions (Bekavac, Petrak, & Buneta, 1994). Peerreview, as the most important component of research evaluation, is often burdened with personal bias and lack of objective evaluation criteria (Marusic & Marusic, 1999), and bibliometric analysis (especially citation analysis) serves as a complementary tool for correcting the weaknesses of peer-review, especially in small scientific communities (van Raan, 1996).

As librarians in an academic medical library, we perform a large number of bibliometric analyses and consider ourselves to be, as Roemer and Borchardt (2013) suggested, "well positioned to carry an informed dialogue on adopting and using of new types of research dissemination tools". To the best of our knowledge, there are no published studies on the altmetric impact of papers from small academic communities, so in this study we focused on the local particularities of one such small setting and its relation to the international trends. Moreover, not even in large international studies did we find time series analysis of altmetric activity on the same/single data set. Our aim was to examine the altmetric echo of papers published by the University of Zagreb School of Medicine (UZSM) in internationally visible journals over two and a half years.

## Materials and methods

*Research questions*

Our study was designed to answer the following questions:

1) What is the altmetric impact of the papers produced by an academic institution in the scientifically peripheral community?
2) Do altmetric indicators found in large international studies correspond to those found in a small scale study focusing on one institution?
3) Do altmetric indicators change with time?
4) Is there any difference in altmetric activity between papers published in a) international and local journals and b) English and local language?
5) What are the characteristics of papers accompanied by the greatest Twitter and Mendeley activity?

*Sample collection*

The University of Zagreb School of Medicine (UZSM) is the largest medical school in Croatia with around 450 faculty members. They publish about 1000 internationally visible journal papers a year. To select a publication sample for this research we chose the Scopus bibliographic database for two main reasons: a) it covers a broad range of international and local medical journals and b) it can generate both citation and altmetric reports for indexed papers.

The Scopus search was run in the early July of 2014, using the UZSM affiliation ID. We found 390 papers authored by the UZMS affiliates, published between 1 January and 30 June 2014. We used this sample to analyse altmetric and citation activity at three time points.

At the first time point, metadata and Scopus citation data for the 390 papers were exported to the CSV format for further analysis. The altmetric activity was checked manually using Altmetric for Scopus, a third-party web application available on the sidebar of Scopus article and abstract pages ("Altmetric for Scopus. Altmetric Support", 2014).

In the second search, which took place a year later, in July 2015, each paper was re-checked for possible changes in all metrics data. We checked them either through their digital object identifier (DOI) or the title. These data were retrieved using the new Scopus Article Metrics module ("New Scopus Article Metrics: A better way to benchmark articles", 2015) (which replaced the Altmetric for Scopus module) that combines citation count and altmetric activity.

All metric data were collected manually. This second dataset included the metrics for January 2014–July 2015.

The third dataset was collected in July 2016 using the same methods as in July 2015. It included the metrics for January 2014–July 2016.

*Data analysis*

Our analysis of data collected at the first time point was focused altmetric and citation activity 0–6 months after the papers have been published. We extracted only Mendeley readership counts and Twitter activity, because social network activity was the most intense on these two platforms.

At the second time point we analysed altmetric and citation activity captured a year after the first analysis. We looked for variations of counts over time and identified the papers that had an increase in a) altmetric and citation counts, b) citation counts only, and c) altmetric counts only. The idea was to see how the intensity and type of social media use changes over time.

The analysis at the third time point was primarily directed at delayed altmetric activities. To determine differences in the use of social media between papers published in local and international journals, we divided the papers in two subsets: 1) published in Croatian journals and 2) all other papers. The first subset was further divided in two groups: a) papers published in Croatian language and b) all others.

We also made an in-depth analysis of papers with the highest Twitter and Mendeley scores, which are going to be discussed as case studies.

## Results and discussion

*Altmetric impact of the analysed papers*

Almost half of the analysed papers (185 of 390) had some type of altmetric activity into the first six months after publication; 25.6% (100 of 390) received at least one tweet, and 36.9% (144 of 390) had at least one Mendeley bookmark. These results correspond to those from a large study conducted by Haustein et al. (2014), who found that more than 20% of PubMed/WoS papers published in 2012 received at least one tweet and that these rates of coverage are much lower than those found for other sources of altmetric data, such as the

readership data generated from Mendeley. The most tweeted paper at the first time point (186 tweets) had only 13 Mendeley bookmarks. It was published in May 2014, two months before our first data collection. In contrast, the paper with the highest Mendeley activity (22 bookmarks) had only four tweets at the first time point. It was published two weeks before the most tweeted paper. This confirms the conclusions of other studies about Twitter and Mendeley as two different types of social media (Haustein et al., 2014), reflecting usage and popularity among different audience groups.

As for Scopus citations, 10.7% of the analysed papers (42 of 390) were cited in this short period. Most of them had altmetric activity as well, and 8.5% of all papers returned both altmetric and citation counts. The most tweeted paper had zero citations and the paper with the most Mendeley counts was at the same time the most cited paper (six citations). Other studies showed that Mendeley mirrors use of papers within the academic community (Haustein et al., 2014) and could be a reliable proxy for citation counts for all medical research fields (Haustein et al., 2014). High correlation between Mendeley readership counts and citation counts suggests that it is also reasonable to interpret Mendeley as an indicator of academic impact (Li, Thelwall, & Giustini, 2012; Maflahi & Thelwall, 2016; Thelwall & Sud, 2016).

Our results from the second time point showed a significant increase in all analysed activities. As many as 77.9% of the papers in the analysed set (304 of 390) were altmetrically active, and 59.7% (233 of 390) were cited at least once. Half (51%) had both indicators and 8.5% (33 out of 390) were not altmetrically active but received one to four citations. Only 13.3% (52 of 390) had neither altmetric nor citation activity.(See Fig. 1.)

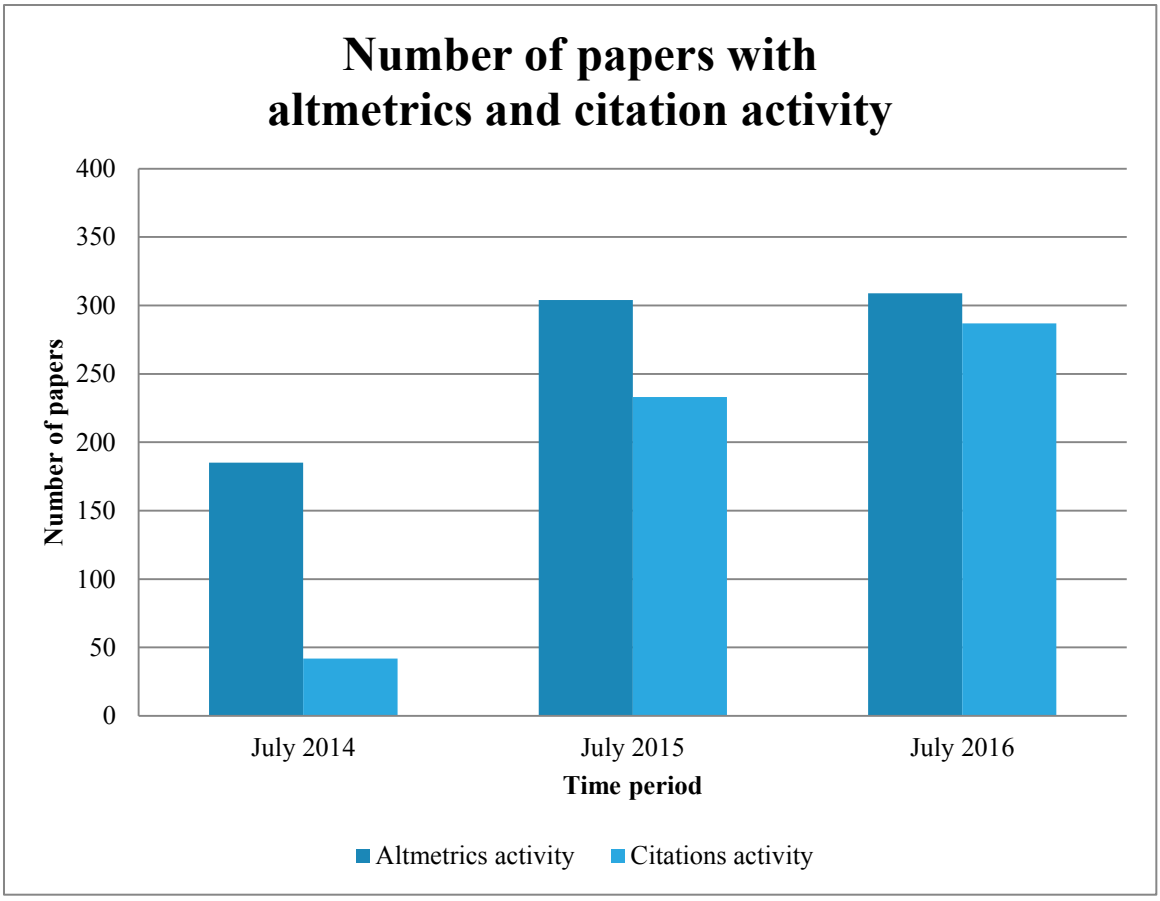


**Fig. 1.** Number of papers with altmetrics and citation activity

The median Mendeley reader rate (5) was 60% higher than the median Twitter rate (3). Both were higher than the median citation rate (2). These findings are in line with the results of the large-scale study by Haustein et al. (2014). The paper most tweeted at the first time point of our study confirms Eysenbach's findings that highly tweeted articles are 11 times more likely to get highly cited than less tweeted articles (Eysenbach, 2012). It was the most cited paper at the second time point (91 citations). However, one paper with significant altmetric activity immediately after the publication (54 tweets and 7 Mendeley readers in July 2014) had only one citation as of July 2015.

In his analyses of tweet dynamics Eysenbach (2012) defined the number of tweets as a function of time since publication and found that the number of new tweetations (Twitter citations) drops rapidly after publication, even for the most cited papers. He mentioned two

distinct phases of tweetation dynamics: the “network propagation phase” over the first 30 days after publication and the “sporadic tweetation phase” with only sporadic mentions of older articles. Our results confirm this, but again, we found exceptions. For example, the Twitter activity of our most tweeted paper showed only a low increase between the first two time points (only 16 new tweets). However, Twitter activity for two papers published in April 2014 intensified only after the first half of 2015.

Mendeley showed a different general trend from Twitter. We identified 16 papers with 25 or more Menedeley readers, and this readership was mainly recorded at the second time point. The paper with the highest Mendeley score (130) had only three Mendeley bookmarks at the first time point. Exceptionally, its number of tweets also increased from 38 at the first time point to 127 at the second.

In comparison to the second time point (July 2015), the third time point analysis (July 2016) showed no significant changes, confirming once again Eysenbach's conclusions (Eysenbach, 2012). Only 15 previously inactive papers became altmetrically active between July 2015 and July 2016. Moreover, 13 papers received additional tweets in this period and only one paper received more than five new tweets. Of the 15 most tweeted papers in 2014, 13 remained among the top 15. As expected, Mendeley activity and citation counts showed higher increase than Twitter and were observed for 71 and 229 papers, respectively.

Generally, our findings at all three time points were in line with the trends observed in the large-scale studies.

*International vs. local journals*

Our next step was to see if there was any difference between local and international journals and/or between publication outlet and altmetric activity. Croatian journals published 20.2% (79 of 390) of all the analysed papers. At the first time point, only seven papers showed

altmetric activity, three of which had Scopus citations as well. At the second time point, 69.6% (55 of 79 papers) of the papers published in Croatian journals showed some altmetric activity. However, the intensity of their activity was low. All were bookmarked, but 11 Mendeley bookmarks was the highest score, and only six had some Twitter activity (1–4 tweets). Papers from Croatian journals showed no increase in altmetric activity between the second and the third time point.

As expected, citation activity increased during the researched period, from three papers with citations in July 2014 to 30 in July 2015 and 43 in July 2016 (Fig. 2.).

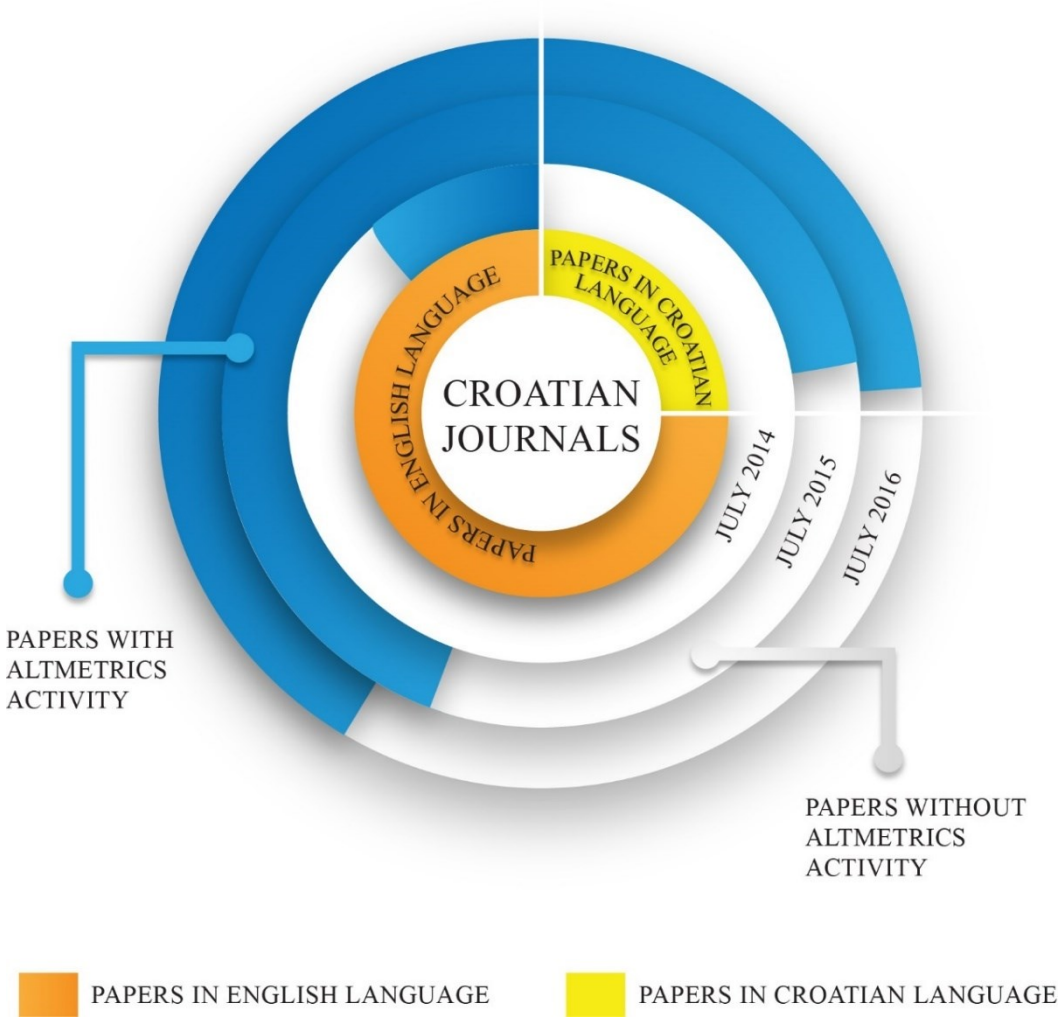


**Fig. 2.** Altmetric activity of papers from Croatian journals at the three time points

Of the papers published in Croatian journals, only 26.6% were in the Croatian language (21 of 79 papers). They had no altmetric activity in July 2014, but 17 of them received tweets and/or Mendeley bookmarks by the second time point, and altogether 18 were altmetrically active at the third time point (with the maximum of only three Mendeley bookmarks). Analysing the science and technology indicators for the peripheries, Raflos, Molas-Gallart, and Wolley (2015) emphasized that language is a major problem for performance measures and that non-English publications have a major influence in the outcomes of indicators. Papers published in local languages have little opportunity to be internationally perceived.

For the Croatian, as well as for the journals published in other scientifically peripheral countries, the marketing role of social media, especially Twitter is not a controversial issue. On the contrary, wider distribution of the published papers is necessary for their visibility. Twitter and other attention grabbing social media stand out as an easy and efficient solution.

Our results indicate that Croatian publishing community has not yet recognised social media as a tool for promoting local research outlets although previous research showed they embraced new trends in scientific publishing, and especially Open Access (Škorić et al., 2016).

*Characteristics of the altmetrically most active papers*

Table 1 and Fig. 3 show the ten altmetrically most active papers in our study.

**Table 1**
List of papers with the highest Twitter and Mendeley activity from Fig. 3.

| | Paper title | Journal title | DOI |
|---|---|---|---|
| **1** | Effectiveness of neuraminidase inhibitors in reducing mortality in patients admitted to hospital with influenza A H1N1pdm09 virus infection: A meta-analysis of individual participant data | The Lancet Respiratory Medicine | 10.1016/S2213-2600(14)70041-4 |
| **2** | Protein intake and exercise for optimal muscle function with aging: Recommendations from the ESPEN Expert Group | Clinical Nutrition | 10.1016/j.clnu.2014.04.007 |
| **3** | Use of probiotics for management of acute gastroenteritis: A position paper by the ESPGHAN working group for probiotics and prebiotics | Journal of Pediatric Gastroenterology and Nutrition | 10.1097/MPG.0000000000000320 |
| **4** | Temporal specification and bilaterality of human neocortical topographic gene expression | Neuron | 10.1016/j.neuron.2013.11.018 |
| **5** | Association between plasma triglycerides and high-density lipoprotein cholesterol and microvascular kidney disease and retinopathy in type 2 diabetes mellitus: A global case-control study in 13 countries | Circulation | 10.1161/CIRCULATIONAHA.113.002529 |
| **6** | Altered global brain signal in schizophrenia | Proceedings of the National Academy of Sciences of the United States of America | 10.1073/pnas.1405289111 |
| **7** | Consensus guidelines of ECCO/ESPGHAN on the medical management of pediatric Crohn's disease | Journal of Crohn's and Colitis | 10.1016/j.crohns.2014.04.005 |
| **8** | Genome-wide association analysis identifies six new loci associated with forced vital capacity | Nature Genetics | 10.1038/ng.3011 |
| **9** | Clinical experience of colistin-glycopeptide combination in critically ill patients infected with gram-negative bacteria | Antimicrobial Agents and Chemotherapy | 10.1128/AAC.00871-13 |
| **10** | The ACC/AHA 2013 guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular disease risk in adults: The good the bad and the uncertain: A comparison with ESC/EAS guidelines for the management of dyslipidaemias 2011 | European Heart Journal | 10.1093/eurheartj/ehu107 |

The paper ranked first by the number of tweets at all three time points also ranked first by the number of Mendeley bookmarks in 2014 and fourth in 2015 and in 2016. This meta-analysis published in a highimpact journal is the result of collaboration of 71 authors. The topic of the paper is potentially interesting even to the general public (pandemic form of influenza A and therapeutic use of neuraminidase inhibitors), and the results of the meta-analysis are clearly important to the practicing medical community. The fact that it received the most tweets immediately after publication (Fig. 3.) is not only a sign of the paper's clinical value but also an early predictor of its future citation rate. With 91 citations in July 2015 and 123 citations in July 2016, this paper is the most cited paper in our study. Also, this is the only paper in our study that shows a remarkable new Twitter activity at the third time point.

The second most tweeted paper at all three time points was ranked first by the Mendeley readership counts in 2015 and in 2016. The paper contains recommendations of an important expert group for protein intake by the elderly. The number of the Mendeley readers in 2015 (scholarly activity) loosely corresponds to the number of tweets at the same time point (social activity), but the echo in both media was not as immediate as in the previous case. The number of times this paper was cited shows considerable growth, and the paper ranks third by the citation rate in 2015 and fourth in 2016.

On our list of altmetrically most active papers there are two preclinical studies. The paper that ranked second by the number of Mendeley bookmarks in 2015 and 2016 is a study on human neocortical topographic gene expression (paper no. 4 in Fig. 3.). It ranked fourth by the number of tweets at all three time points. Another is a meta-analysis on loci associated with forced vital capacity, published in a prestigious international journal (paper no. 8 in Fig. 3.). It has quite a different altmetric pattern, with lower Mendeley and Twitter activity than paper no. 4 (16 vs. 39 and 37 vs. 71, respectively). Its citation rate is also lower.

All other high-ranking papers come from the clinical setting and with their epidemiological data and/or recommendations for clinical practice target clinical professionals. These results corroborate the conclusions of other authors that certain types of articles appeal more to the public than others because of their potential impact on health issues and everyday life or because of their usefulness to professional community (Andersen & Haustein, 2015). Meta-analyses, systematic reviews, and clinical trials are tweeted and bookmarked much more often than other medical papers, confirming the pattern already known from citation analysis that study designs with higher methodological rigor have a higher citation rate than other study designs (Royle, Kandala, Barnard, & Waugh, 2013). An exception to this pattern is our

second best cited article reporting clinical guidelines for the treatment of blood cholesterol (107 citations), which received quite modest social media coverage (Fig. 3.).

No paper published in the local Croatian journals made to the top ten altmetrically active papers in our analysis.

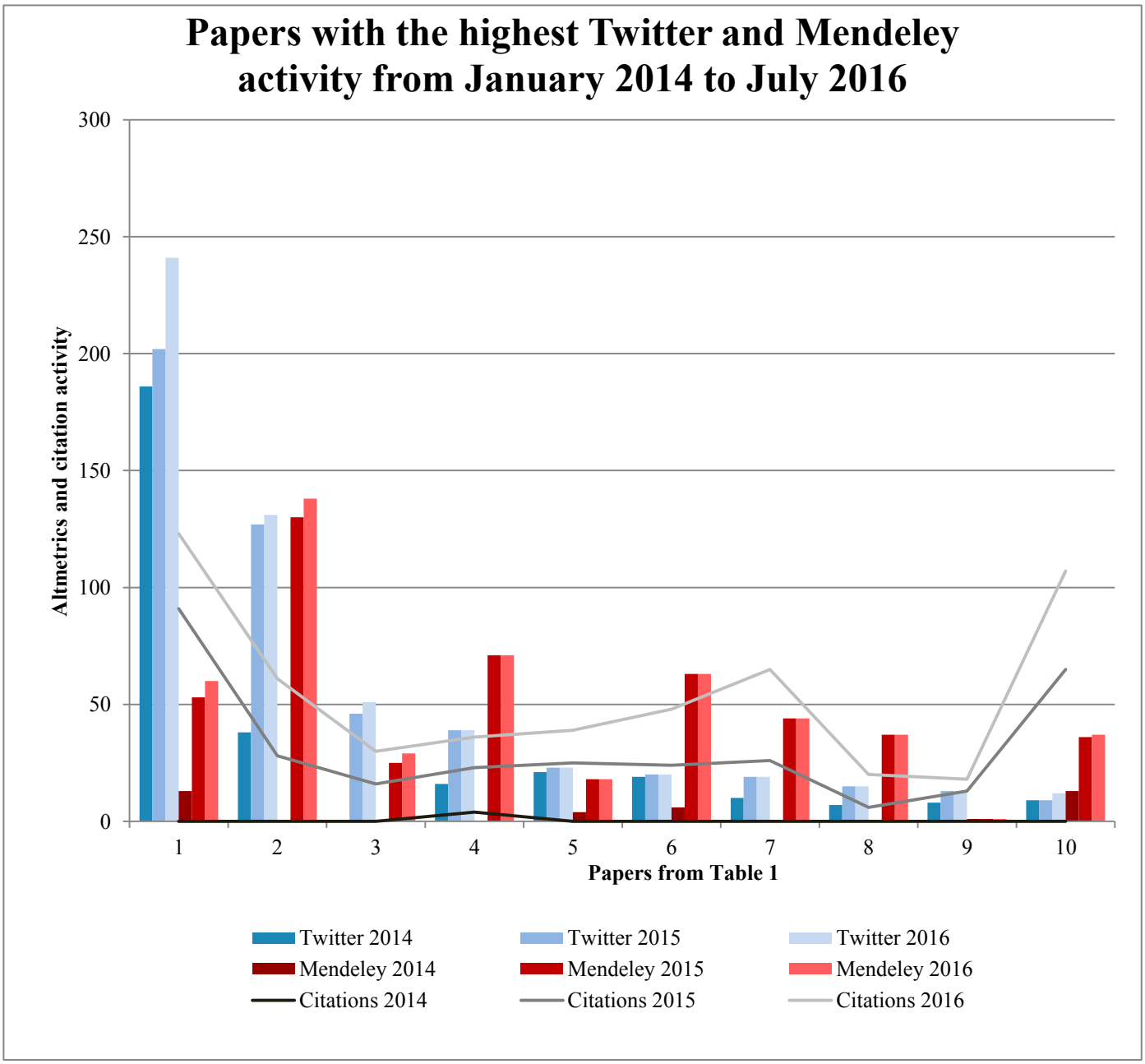


**Fig. 3.** Papers with the highest Twitter and Mendeley activity from January 2014 to July 2016 (ranked by tweet count)

In a recent comprehensive literature review on factors affecting citation rate, Tahamtan, Safipour Afshar, and Ahamdzadeh (2016) identified twenty-eight factors predicting the frequency of citations. Our results show that many of them, e.g. study topics, study design,

document type, journal's reputation, language of the journal, number of authors, author's country, visibility, and international cooperation, are also affecting the intensity of altmetric activity.

*Study limitations*

Sugimoto (2015) has already pointed to issues of poor credibility and validity of altmetric indicators for the academic community. To this list we would also like to add inconsistency! As an illustration, the search for a paper on our list (Gut 2014;63(4):588–97) at the second time point returned 57 Mendeley readers registered by the Scopus's Article Metrics, 75 readers in the Mendeley database, and 45 Mendeley readers in the Croatian Scientific Bibliography database ("Croatian Scientific Bibliography database,", 2016) linked to Altmetric.com. Manual checks and comparisons only confirmed this inconsistency in a number of records. Part of the reason for this inconsistency may be that the users of social media platforms can control their posts by deleting them or even deleting their profiles on Twitter and Mendeley.

Another limitation of our study is the small sample size, as it may undermine the interpretation of data and their practical value in other settings. However, our results give sufficient information to be able to discuss local specifics in the context of larger, more relevant studies.

**Conclusions**

Our results confirm the findings of larger studies that altmetric indicators can shed light on dissemination of scientific literature among the general public and on the attention some research findings receive by the professional community. As we expected, altmetric activity is more intense for papers published in renowned international journals and for multicentric and/or clinical study-type papers. But papers published in Croatian journals showed one additional anomaly – they received minimal altmetric attention at the first time point and only became active at the second time point. However, their overall altmetric score is very low, as well as their citation rate. Alperin (2013) argues that altmetrics can promote conversation about otherwise unseen research and may change focus to locally important scientific issues. Along these lines, we believe that journals and authors from scientific peripheries should

embrace the opportunities provided by social media if they wish to increase their international visibility and impact.

Could altmetric indicators change the framework UZSM and other academic medical institutions use to evaluate its researchers? We do not think so. With one exception, our results show that highly cited papers also have the highest altmetric activity. What about the impact research information has on the public? This has not yet become part of the appraisal of institutional and/or individual academic merit, at least in Croatia. However, the Croatian Ministry of Science, Education and Sports has added popularisation of science among the criteria that public universities and research institutes have to meet to receive funding (Ministarstvo znanosti obrazovanja i sporta Republike Hrvatske, 2015).

The evaluative potential of altmetric indicators has to be further explored in the broader context. Although one must not confuse activity on social networks with actual societal impact, we believe that altmetrics can be used as a valid indicator in the overall appraisal of a medical school's performance.

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