Coverage and distribution of altmetric mentions in Spain: a cross-country comparison in 22 research fields

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Abstract

Since their formal proposal in 2010, various studies have been carried out on altmetrics from different perspectives and at different levels. However, the problem of the country-specific differences found in such studies has not been addressed in depth and considering the wide range of social media sources. This paper presents a cross-country comparison of altmetric coverage between Spain and a selection of 16 countries (EU-15 and the United States) in 22 research fields. All Spanish publications indexed in *Web of Science* that were published between 2016 and 2020, as well as all mentions of their altmetrics collected on *Altmetric.com*, were retrieved. The results show that, of the 434,827 Spanish publications considered, 55% are found on *Altmetric.com*. General altmetric coverage in Spain is similar to that in the rest of Europe and the United States, but it is in areas such as Arts & Humanities and Social Sciences where the lowest levels of coverage are found, although in the case of the latter the publications receive a higher number of mentions. Spanish publications reach a total of 3,569,553 mentions from different social media platforms, but *Twitter* is the main source of these mentions, accounting for 89%. Differences between research fields are also found, such as Environment & Ecology receiving a higher number of policy mentions.

Keywords

Altmetrics; Spain; Europe; United States; Scientific production; *Altmetric.com*; *Web of Science*; Coverage; Social media; Research fields.

1. Introduction

More than a decade after altmetrics were first proposed (**Priem** *et al.*, 2010), their expansion and integration into the bibliometric toolbox complementing citation indicators have become a reality (**Wouters**; **Zahedi**; **Costas**, 2019). Although the research front of altmetrics can still be considered "emerging," its expansion is undeniable. It has grown both as a scientific topic of interest and as a commercial toolbox now integrated into many scientific information systems. Altmetrics fell short in their promise of quantifying societal impact (**Tahamtan**; **Bornmann**, 2020) and suffer from serious technical and conceptual limitations (**Sugimoto** *et al.*, 2017), especially when used as an alternative to citation counts (**Robinson-García** *et al.*, 2017). Still, they are valued for their capacity to provide a broader perspective on how scientific literature is perceived and consumed within and beyond academia. They can provide unique insight especially when combined with advanced methodological techniques or used in case studies.

Altmetric data have been used to characterize socio-semantic communities sharing common scientific interests (**Arroyo-Machado**; **Torres-Salinas**; **Robinson-García**, 2021; **Van-Schalkwyk**; **Dudek**; **Costas**, 2020), to study the nexus between society, policy, and science (**Nane** *et al.*, 2021), to identify researchers active on social media (**Ferreira**; **Mongeon**; **Costas**, 2021), and specifically to address differences in interests between academia and the general public (**Haunschild** *et al.*, 2019). These studies reflect a shift from looking for measures of impact to using altmetrics to understand social engagement with science (**Díaz-Faes**; **Bowman**; **Costas**, 2019; **Robinson-García**; **Van-Leeuwen**; **Ràfols**, 2018). Still, systematic and descriptive analyses of the altmetric patterns across countries and fields are needed to understand how methodological choices affect analyses and the interpretation of their findings. So far, there is evidence of a lack of direct interaction of *Twitter* users with the scientific papers they share (**Robinson-García** *et al.*, 2017; **Fang** *et al.*, 2021). We know that altmetric data revolve mostly around the fields of Health Science, Social Sciences & Humanities, and Life & Earth Sciences (**Fang** *et al.*, 2020), but there is evidence pointing at notable differences by country (**Robinson-García**; **Jiménez-Contreras**; **Torres-Salinas**, 2016; **Torres-Salinas** *et al.*, 2018). There are also technical limitations derived from the altmetric providers themselves. **Zahedi** and **Costas** (2018) reported "substantial differences" in the metrics obtained by each provider in terms of how they access, collect, aggregate, and update their data, while **Ortega** (2020) reported a bias toward English language in blogs and news media mentions from both *Altmetric.com* and *PlumX*, currently the main altmetric data providers.

This paper aims to fill this gap by providing a cross-country comparison of altmetric coverage between Spain and a selection of 16 countries in 22 research fields. So far, national analyses have been scarce in the literature. For instance, **Eldakar** (2019) analyzes Egypt's research output using *Mendeley* readership as a proxy for impact. **Park** and **Park** (2018) analyze the output of five Asian countries using *Mendeley*, *Facebook*, and *Twitter* as sources. Also in Asia, **Cho** (2017) studied the case of Korea, focusing on four academic fields using altmetric indicators, and observed significant differences between the Humanities and Medical Sciences. **Holmberg** and colleagues (2019) have extensively researched the Finnish landscape, studying the level of internationalization of its outputs (**Didegah** *et al.*, 2017), differences between citations and altmetrics (**Didegah**; **Bowman**; **Holmberg**, 2018), contextual factors influencing altmetric mentions (**Holmberg** *et al.*, 2019), and differences of mentions depending on open access (**Holmberg** *et al.*, 2020). In the case of Spain, the altmetric coverage was explored at the institutional level (**Torres-Salinas** *et al.*, 2018). Forty-two percent of the Spanish literature reports altmetric data (**Torres-Salinas** *et al.,* 2018), with lower coverage for the Social Sciences and Humanities than is observed worldwide (**Costas**; **Zahedi**; **Wouters**, 2015).

We expand herein on previous analyses by comparing the altmetric coverage of the Spanish research output with that of 15 European countries as well as the United States. We focus specifically on *Altmetric.com* as one of the main altmetric data providers (**Robinson-García** *et al*., 2014), currently covering 15 different data sources[1]. The main objective is to provide a cross-country overview using which we can compare altmetric indicators and contextualize the patterns observed. This analysis is done for 22 research fields, and the altmetric data are then presented by altmetric source. Specifically, we address the following objectives:

- To analyze the coverage of *Altmetric.com* for Spanish scientific production indexed in *Web of Science*, both at a general level and for 22 scientific fields.
- To establish which platforms or social networks generate and concentrate the greatest number of mentions in the case of Spanish scientific production.
- To determine which platforms are the most appropriate for and best adapted to the different scientific fields by analyzing the statistical differences between them.

This paper will provide objective information on the suitability of *Altmetric.com* as an information source at the national level. It will also enable us to establish possible limitations on its use by scientific fields and determine the most appropriate platforms and indicators for the different fields.

2. Data and methods

We collected data from three sources: *Web of Science*, *InCites*, and *Altmetric.com*. Data were retrieved on 3 March 2021. We first downloaded the complete research output published between 2016 and 2020 for which an author with a Spanish affiliation was listed from *Web of Science* using the search field "Address." The query was limited to the following document types: articles, editorial material, letters, and proceedings papers. We only retrieved records indexed in one of the four main citation indexes in the *Web of Science Core Collection*: *Science Citation Index Expanded* (*SCI-Expanded*), *Social Sciences Citation Index* (*SSCI*), *Arts & Humanities Citation Index* (*A&HCI*), and *Emerging Sources Citation Index* (*ESCI*). A total of 434,827 records were downloaded and exported to *InCites*. This export was performed to reclassify records categorized as "Multidisciplinary" in *Web of Science*. Still, after this, 1,171 publications had to be assigned manually.

To identify our set of records on *Altmetric.com*, we used the digital object identifier (DOI) assigned to each publication from *Web of Science*. *Altmetric.com* relies heavily on document identifiers (**Robinson-García** *et al.*, 2014). A total of 406,621 records included a DOI (93.51%), among which 238,508 were indexed on *Altmetric.com* (54.85% of the total), linked to a total of 3,596,296 mentions. We removed *Mendeley* as a source as it is only indexed when a mention has been tracked from at least one of the other sources (**Robinson-García** *et al.*, 2014).

Records were classified into the 22 research fields included in the *Essential Science Indicators* (*ESI*) provided by *Clarivate*. This classification is conducted at the journal level. To do so, we matched the 254 subject categories from *Web of Science* with the *ESI* classification following the equivalence schema proposed by **Tan** (2020). Subject categories included in the *A&HCI* are not integrated into the *ESI* classification. For this reason, we created an Arts & Humanities research field, which included records coming from this index. More information on the data collection and processing as well as the overarching project of this study is available at *http://influscience.eu*

Furthermore, a comparison was made between European countries (EU-15) and the United States following the reverse process for data retrieval. From all the publications indexed on *Altmetric.com*, as of 11 May 2021, the bibliographic data were extracted from *Web of Science* using the DOI and filtered by the same publication years and documental types as for Spain. The publications were categorized by country according to the author affiliations listed (field "Address"). In total, for the 15 European countries, including Spain, among the 2,927,043 publications available in *Web of Science*, 1,648,640 were indexed on *Altmetric.com* with at least one mention from any source, while for the United States, of the 2,506,632 publications in *Web of Science*, 1,532,263 had at least one mention on *Altmetric.com*.

3. Results

3.1. General results and coverage of fields

Figure 1 shows the scientific output of Spain by research field as well as the share covered by *Altmetric.com*. Thirteen research fields are above the Spanish coverage baseline, indicated by a blue line. Most of the fields with the best coverage are related to
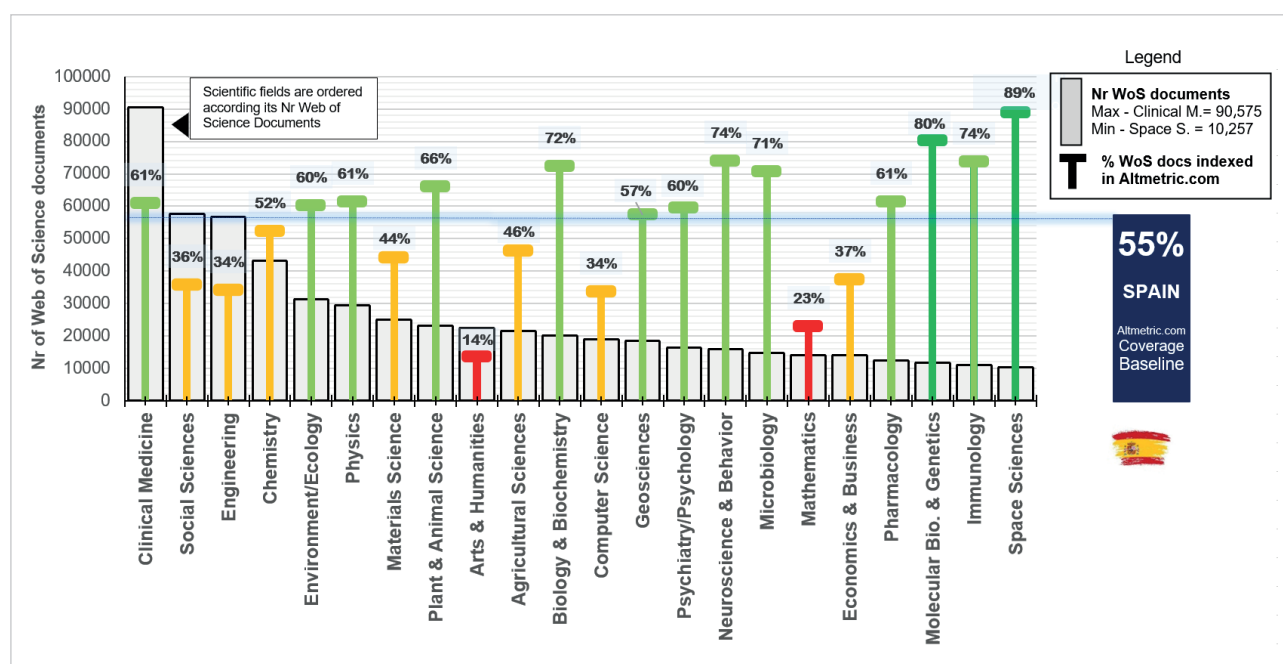

Figure 1. Coverage of *Web of Science* Spanish documents indexed on *Altmetric.com* for 22 scientific fields during the period 2016-2020.

Health Sciences and Biology. For example, Clinical Medicine is the research field with the highest scientific output, exhibiting an altmetric coverage of 61%. The fields with the highest coverage are Space Science (84% of the total), Molecular Biology & Genetics (80%), Neuroscience & Behavior, and Immunology (74%, respectively). At the other end, we observe Arts & Humanities with only 14% of its output covered by *Altmetric.com*, followed by Mathematics (23%), Engineering (34%), and Social Sciences (36%).

Figure 2 and Table 1 compare Spain with 16 other countries. Figure 2 shows the overall coverage of Spain on *Altmetric.com* alongside other European countries and the United States. Fifty-six percent of the output of the main European Union (EU-15) countries is covered, revealing that Spain seems to show a pattern similar to that of the EU. However, it exhibits a lower coverage compared with the United States (61%). English-speaking countries (e.g., United Kingdom and Ireland) and Nordic countries (e.g., Denmark and Finland) present the highest coverage values, sometimes close to 70%. Spain has coverage very similar to Germany (56%), France (55%), and Portugal (53%).

Table 1. Coverage comparison of *Web of Science* documents indexed on *Altmetric.com* for Spain, EU-15, and the United States considering 22 scientific fields during the period 2016-2020

	Spain	EU-15	USA
Agricultural Sciences	46.33%	49.69%	52.54%
Arts & Humanities	13.65%	29.66%	29.02%
Biology & Biochemistry	72.36%	72.19%	75.19%
Chemistry	52.38%	50.60%	53.24%
Clinical Medicine	60.94%	62.06%	68.56%
Computer Science	33.68%	32.18%	31.87%
Economics & Business	37.38%	49.84%	49.78%
Engineering	34.19%	29.25%	29.40%
Environment/Ecology	60.32%	61.89%	65.50%
Geosciences	57.32%	52.87%	55.26%
Immunology	73.68%	74.72%	79.30%
Materials Science	44.25%	37.92%	40.72%
Mathematics	22.98%	23.94%	24.66%
Microbiology	70.71%	75.04%	78.90%
Molecular Biology & Genetics	80.22%	77.76%	80.02%
Neuroscience & Behavior	73.96%	75.98%	76.93%
Pharmacology & Toxicology	61.39%	61.92%	64.53%
Physics	61.37%	54.52%	55.49%
Plant & Animal Science	66.15%	65.65%	67.58%
Psychiatry/Psychology	59.55%	71.89%	71.73%
Social Sciences, General	35.74%	63.67%	63.39%
Space Sciences	88.93%	86.17%	85.48%

The color of each cell represents the percentage, ranging from white (0%) to red (100%).

Table 1 breaks down the Spanish research output by research field and compares it with that of the EU-15 and the United States. Spain has lower coverage than these regions in 14 research fields, although the difference is minor in most of them. Exceptions can be found in the Arts & Humanities, Psychiatry/Psychology, Economics & Business, and Social Sciences. Spain presents a slightly better coverage on *Altmetric.com* in the fields of Physics, Space Sciences, and Material Science.

3.2. Number of mentions

In total, Spain's research output has been mentioned 3,569,553 times in the different sources covered by *Altmetric.com*. *Twitter* is the platform that generates the highest number of mentions, with a total of 3,183,505. This means that *Twitter* mentions account for 89% of the output covered, with an average of 13.4 mentions per article. The rest of the platforms have an average of less than one mention in all cases. The next platform in terms of mentions is news media, with 200,772 (5.6%). Excluding social media platforms, mentions in *Wikipedia* and policy mentions stand out, with 11,151 and
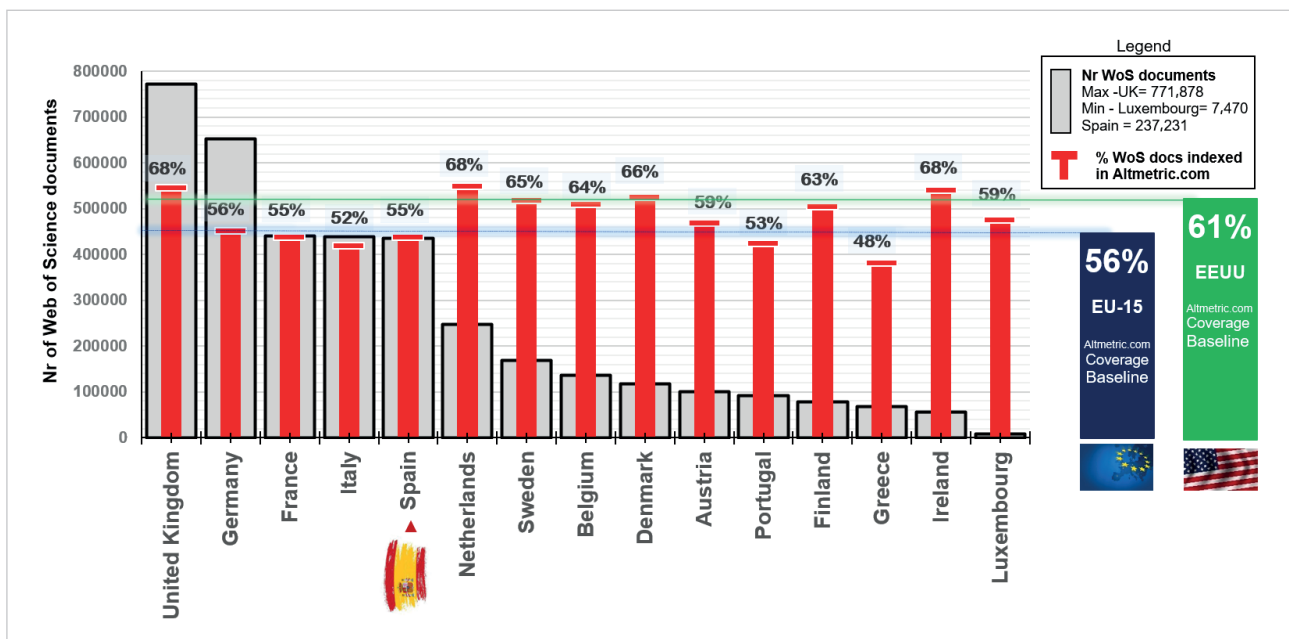

Figure 2. Coverage comparison of *Web of Science* documents indexed on *Altmetric.com* for main European countries and the United States during the period 2016-2020.

Table 2. Distribution of publications and mentions between *Altmetric.com*'s platforms for the Spanish *Web of Science* documents during the period 2016–2020

Mentions of...	Publications	Mentions		Descriptive statistics		
		Sum	Percentage	Mean	Standard deviation	Max
Twitter	208,253	3,183,505	89.185%	13.421	96.987	15,695
News	26,167	200,772	5.625%	0.846	8.461	1,429
Facebook	48,824	99,840	2.797%	0.421	1.866	179
Blog	20,750	38,729	1.085%	0.163	1.058	119
Wikipedia	5,989	11,151	0.312%	0.047	0.859	208
Google	4,518	9,658	0.271%	0.041	0.824	254
Policy	4,569	7,785	0.218%	0.033	0.392	58
Patent	3,111	5,353	0.150%	0.023	0.317	39
Reddit	3,294	4,822	0.135%	0.020	0.240	27
Video	1,863	2,852	0.080%	0.012	0.209	28
F1000	2,161	2,563	0.072%	0.011	0.127	9
Peer review	1,231	2,303	0.065%	0.010	0.187	29
QA	186	218	0.006%	0.001	0.043	11
Weibo	2	2	0.000%	0,000	0.003	1
LinkedIn	0	0	–	–	–	–
Pinterest	0	0	–	–	–	–
Syllabi	0	0	–	–	–	–
Altmetric Attention Score	220,288	3,366,965		141,94	89,881	12,915

7,785, respectively. Platforms closely linked to a region (e.g., *Reddit*, *QA*, *Weibo*) generate very few mentions, while there are sources that generate no mentions at all (*LinkedIn* and *Pinterest*). Also included in the table is the *Altmetric Attention Score* (AAS) with a national average of 14.2, clearly determined by *Twitter* mentions.

Twitter, news, and policy mentions contribute more than 80% of the total mentions in seven research fields. In all three cases, Clinical Medicine accumulates more than 30% of the mentions. In the case of *Twitter*, Clinical Medicine accumulates 36% of all mentions, followed by Environment & Ecology with 11%. For policy mentions, the situation is similar,

Table 3. Example of the *Essential Science Indicators* (*ESI*) fields that contribute the highest number of mentions for four *Altmetric.com* indicators: *Twitter*, news mentions, policy mentions, and *Wikipedia*

Twitter	Mentions	
	Number	%
Clinical Medicine	1,149,816	36
Environment/Ecology	349,476	11
Social Sciences, General	289,339	9
Biology & Biochemistry	271,073	9
Molecular Biology & Genetics	268,242	8
Plant & Animal Science	199,296	6
Neuroscience & Behavior	180,656	6
Accumulated percentage		85

News mentions	Mentions	
	Number	%
Clinical Medicine	63,474	32
Space Sciences	20,313	10
Molecular Biology & Genetics	19,674	10
Environment/Ecology	18,223	9
Biology & Biochemistry	16,463	8
Neuroscience & Behavior	13,666	7
Social Sciences, General	12,753	6
Accumulated percentage		82

Policy mentions	Number	%
Clinical Medicine	2,734	35
Environment/Ecology	1,732	22
Social Sciences, General	1,031	13
Geosciences	639	8
Economics & Business	584	8
Immunology	553	7
Accumulated percentage		93

Wikipedia	Number	%
Space Sciences	1,747	16
Plant & Animal Science	1,686	15
Geosciences	1,467	13
Clinical Medicine	1,174	11
Social Sciences, General	1,136	10
Molecular Biology & Genetics	1,003	9
Accumulated percentage		74

although Environment & Ecology accounts for 22% of the total mentions. In the case of news, Space Science stands out with 10%. In these three cases, Social Sciences and areas linked to Life Sciences and Biology appear in this platform as a prominent field. The only platform that follows a different pattern is *Wikipedia*. Mentions are much more spread out across fields, and the distribution of mentions is not as asymmetrical. The research field that occupies the first position in the case of *Wikipedia* mentions is Space Science, with 16%. We also find fields such as Plant Science or Geosciences that do not stand out in any of the other platforms.

> This paper provides a comparison of alt-metric coverage between Spain and 16 countries in 22 research fields

Figure 3 shows the average number of mentions by source type. In the case of *Twitter*, Molecular Biology & Genetics, Clinical Medicine, and Biology & Biochemistry have the highest averages with 28.6, 20.8, and 18.4 mentions per paper, respectively. News mentions seem to revolve mostly around the field of Space Sciences with 2.2 mentions, but also around Molecular Biology & Genetics (average, 2.1) and Neurosciences & Behavior (average, 1.2). When focusing on policy mentions, a different picture emerges. The most cited fields are Economics & Business (average, 0.1) and Environment & Ecology (average, 0.1). *Wikipedia* averages are more similar between fields. Still, Space Sciences and Geosciences stand out with averages of 0.2 and 0.1, respectively. Thus, we see that each type of mention is closely related to a specific research field.

4. Final remarks

This article presents results that enable one to quantify and contextualize the altmetric indicators of Spanish documents indexed in *Web of Science*. These results are part of the *Influscience* project, which aims to provide more detailed knowledge of the characteristics of altmetrics in Spain, enabling their more appropriate application.

In relation to the first objective, viz. analysis of coverage, Spain reached a coverage of 55% in altmetrics. This coverage is not homogeneous among the 22 fields analyzed. There is a clear bias toward the areas of Life & Health Sciences, whereas the areas of Exact Sciences, Social Sciences, and Arts & Humanities have poor coverage. This has clear implications, at least for Spain, as *Altmetric.com* should be used with a certain caution in these areas. Such inhomogeneous coverage may be due to a higher number of Spanish scientific journals or to a lower propensity of these scientific communities to disseminate their articles via social networks.

In any case, overall, we do not observe a bias against Spanish output on *Altmetric.com*. Coverage is similar to that of the European Union as a whole and almost identical to that of the most advanced countries in geographical

> *Twitter* is the platform that generates the highest number of mentions, a total of 3,183,505

	Size	AVERAGE			
		Twitter	News Mentions	Policy Mentions	Wikipedia
Agricultural Sciences	■	9,874	0,629	0,034	0,021
Arts & Humanities		6,395	0,310	0,003	0,084
Biology & Biochemistry	■	18,521	1,125	0,009	0,067
Chemistry	■	5,083	0,283	0,003	0,016
Clinical Medicine	■■■	20,841	1,151	0,050	0,021
Computer Science		7,756	0,175	0,010	0,021
Economics & Business		9,366	0,281	0,111	0,022
Engineering	■	4,915	0,289	0,021	0,019
Environment/Ecology	■■	18,434	0,961	0,091	0,038
Geosciences		13,881	1,118	0,060	0,137
Immunology		17,023	0,910	0,068	0,024
Materials Science	■	4,416	0,360	0,004	0,015
Mathematics		5,946	0,145	0,008	0,015
Microbiology	■	13,400	0,501	0,028	0,046
Molecular Biology & Genetics	■	28,634	2,100	0,008	0,107
Neuroscience & Behavior	■	15,388	1,164	0,018	0,031
Pharmacology & Toxicology	■	7,501	0,429	0,027	0,033
Physics	■	6,368	0,532	0,003	0,029
Plant & Animal Science	■	12,999	0,580	0,032	0,110
Psychiatry/Psychology	■	13,432	0,865	0,028	0,029
Social Sciences, General	■	14,024	0,618	0,050	0,055
Space Sciences	■	9,293	2,192	0,002	0,189

Figure 3. Average number of mentions of Spanish scientific production in the *Essential Science Indicators* (*ESI*) fields for four indicators (*Twitter*, news, policy, and *Wikipedia*)
The graphical elements should be read vertically per platform. The bars in each cell represent the value, the arrows the position of the category, and the green boxes the three categories with the highest values.

proximity to Spain. It is very similar to that of France, Italy, and Germany, which show no significant differences in coverage. However, we do observe a bias toward English-speaking countries as well as Nordic countries, as found elsewhere (**Ortega**, 2020). Another important

> **Spanish output in *Altmetric.com* coverage is similar to that of the European Union**

finding concerns differences between research fields. The coverage for Arts & Humanities and Social Sciences in Spain is worse than for the EU-15 or the United States. Therefore, one can conclude that, although we do not observe differences in the overall coverage toward Spanish literature, we do observe notable differences in specific research fields.

When interpreting these data, it is important to consider the use of *Web of Science*, which has a traditional Anglo-Saxon bias (**Hicks**, 1999). This is evident in the data studied: in the case of Spanish scientific production, 84% of the publications are written in English. Therefore, language is a factor to consider when interpreting the data. Furthermore, if we consider only the publications indexed on *Altmetric.com*, this difference increases: 95% of the publications are in English. Thus, areas such as Arts & Humanities, where 71% of the papers are in Spanish, are clearly disadvantaged. These results coincide with those of **Yang** et al. (2021), who detected a favorable bias in both coverage and altmetric values for English publications, and suggest that this situation represents a limitation of *Altmetric.com* in studying research fields such as Humanities.

Finally, we observe that the gross distribution of altmetric mentions is highly concentrated on *Twitter*, which contributes 89% of the total, as also reported for the overall database (**Robinson-García** et al., 2014). Furthermore, Clinical Medicine is the field collecting the most altmetric activity, also following the global pattern (**Costas**; **Zahedi**; **Wouters**, 2015). However, if we analyze each of the sources available on *Altmetric.com*, we find that their presence or absence seems to be related to the research field. For instance, policy mentions are more visible in Environment & Ecology, whereas news mentions and *Wikipedia* mentions have a higher presence in papers related to Space Science. Finally, while Social Sciences tend to have a lower coverage, they accumulate a large number of mentions per paper.

Altmetrics still need to be refined before being used as a valid and useful source for the development of research metrics, although we observe that there is a compelling stream of papers developing new methods and techniques that could improve their application in real-world scenarios. However, we observe that many more descriptive analyses are needed to better understand the quality of the data sources used and differences by research field and country, as well as the use of altmetrics for profiling at different levels of aggregation.

> **Clinical Medicine is the research field with the highest altmetric coverage: 61%**

5. Note

This information is being updated constantly and can be tracked on:
https://help.altmetric.com/support/solutions/folders/6000237990/page/1

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