

Exploring the Effectiveness and Accessibility of Lay Summaries in Four Open-Access Journals

Manvir Kaur Chima¹

1. McMaster University, Honours Life Sciences (Minor in Psychology), Class of 2022

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SUMMARY

Open-access journals are journals without any form of financial or legal barrier to publication. Articles in open-access journals include lay summaries, which intend to summarize research in a manner that is understandable by a general audience. In many open-access journals, lay summaries fall flat when conveying research. This study aimed to characterize the features of lay summaries to better understand areas of weakness. 20 summaries were analyzed from four open-access journals: *PLOS Medicine*, *PNAS*, *Sage Open*, and *Frontiers in Psychology*, using McMaster University's *LIFESCI 2AA3: Introduction to Topics in Life Sciences* rubric. This rubric was created by Dr. Katie Moisse, assistant professor of curriculum and pedagogy at McMaster University, School of Interdisciplinary Science. *PLOS Medicine* ranked highest for all four criteria with an overall average of 14.6 out of 20, while *SAGE Open* typically ranked on the lower end with an overall average of 9.6 out of 20. The differences between journal scores are likely due to varying author guidelines set by each journal. The findings are significant as they imply necessity for cohesiveness in guidelines on lay summary construction between journals, to make better use of taxpayer dollars and better translate scientific findings to society. Limitations include the limited sample size and the lack of inter-rater reliability. Future studies can assess a larger sample size and broader scope of journals to formulate more generalizable conclusions.

ABSTRACT

Lay summaries are an important aspect of research, as they aim to summarize scientific findings in a manner that is accessible to a lay audience. However, lay summaries often incorporate scientific and technical jargon, which makes it difficult for the public to understand research that they are indirectly funding. This study aimed to analyze lay summaries published in four open-access journals to compare differences in effectivity and accessibility when authors summarize the key points of a research study. Four open-access journals, *PLOS Medicine*, *PNAS*, *Sage Open*, and *Frontiers in Psychology* were analyzed using McMaster University's *LIFESCI 2AA3: Introduction to Topics in Life Sciences* rubric. This rubric was created by Dr. Katie Moisse, assistant professor of curriculum and pedagogy at McMaster University, School of Interdisciplinary Science. The rubric judges for an accurate summarization of the study rationale, knowledge gap, methods, results, conclusions, limitations, and next steps, while ensuring accessibility and clarity. Results indicate that total scores are statistically significant between *PLOS Medicine* and *PNAS*, *SAGE Open*, and *Frontiers in Psychology*, but not between *PLOS Medicine* and *Frontiers in Psychology*. A lack of cohesion between journal instructions along with a decreased emphasis on scientific and technical jargon may allude to the disparity seen amongst scores for these four journals. This research depicts specific disparities between open-access journals, which may help revise journal guidelines to ensure cohesiveness and lay audience understanding.

Keywords: Lay summary, open-access, *PLOS Medicine*, *PNAS*, *SAGE Open*, *Frontiers in Psychology*

INTRODUCTION

A key skill in the field of scientific research is effectively conveying complex medical and/or scientific ideas to a lay audience. A lay audience is an audience which does not have expert knowledge on scientific concepts, and as such, require research to be conveyed in an ac-

cessible manner.⁸ For this reason, lay summaries, also referred to as inclusive summaries, are widely used in the press, research journals, funding sources, institutional review boards, and organizations to publicly express scientific research in a manner that is understandable by the lay audience.³

What is a lay summary?

Lay summaries are used widely to convey science to businesses, charitable organizations, and members of the general public.¹⁰ Lay summaries are key tools in conveying research results to clinical participants, and pitching research proposals to funding boards such as the Canadian Tri council.⁴ They include information about the background, aims of the study, significance, methods, results, conclusion, limitations, and next steps.¹⁸ A clear, well-written lay summary aids in the dissemination of science beyond the scope of academics. Lay summaries not only convey the science but add meaning to it by emphasizing its significance to the world of research. Lay summaries are of importance as they bring about awareness surrounding scientific topics to the public. They are also extensively used in securing funding for research projects.¹⁸

An effective lay summary tells the reader enough information to get a grasp of the research and understand the results, significance, and key takeaways. To enhance accessibility, lay summaries should be written in plain English, such that there is no scientific jargon in use, with abbreviations spelt out the first time they are used, and technical terms explained.¹⁸ Authors should answer the question “so what?” in their summaries, which is typically a question of interest for readers to gain an understanding of why the research is important and the impact that it has on society, if any.¹⁸

According to Dubé & Lapane,³ a successful lay summary encompasses a balance between oversimplified information and scientific explanations. To add creativity and maintain interest, analogies are used to express a concept and make it more relatable to everyday life.⁸ It is important to exclude uninteresting and/or hard-to-understand concepts, and instead use visual aids, along with writing in the active voice.¹⁶ Using visual aids makes the scientific concept more relatable, and the use of active voice prevents sentences from being too wordy, thereby improving clarity. Linte⁸ advises using short sentences and brief arguments to ease the digestion of information. A key tactic to uncovering whether a lay summary is written in accordance with a general audience is to ask a family member or friend who does not have knowledge on the topic to read it and provide feedback.⁸ It is important to note the difference between an abstract and lay summary; specifically that an abstract is a summary written in technical terms.

Lay summaries are an important part of publicly-funded research. There is evidence that suggests that the public resorts to published medical research when combating their own health issues.⁷ The general public reacted positively towards open-access research and found it advantageous to research medical conditions

and better understand the phenomena that they experience in their day-to-day.²² Tustin reported that individuals who are dissatisfied with medical professionals resort to open-access journals as a way to obtain medical information.²⁰ The public thus sees this as a positive coping mechanism for managing their illness as it provides them with knowledge, and feelings of involvement and certainty for their conditions.²⁰

The inability to convey the research and results of a study effectively leads to the spread of misinformation, a lack of credibility, and a lack of applicability of that research study to future projects. Although this is detrimental to researchers, the impact it has on the general taxpaying public must not be overlooked. The public is not fully aware of how their tax money is being spent.¹⁰ Simply making research available is not sufficient for its understanding. Issues arise when there is a lack of understanding of open-access journals due to technical jargon in lay summaries. The public instead resorts to lay sources for medical information rather than primary research, which may be deemed unreliable as lay sources are often not peer-reviewed, investigated by scientists, or written by medical professionals.¹⁰

To date, lay summaries are used broadly in various organizations and open-access journals as they continue to expand science and health literacy. Unfortunately, lay summaries are not as accessible to their audience as they originally are set out to be. There is no concrete definition provided to scientists in terms of what constitutes jargon and what is considered “plain English,” which may contribute to the inconsistency in lay summaries among open-access journals.

Lay summaries in open-access journals often go by different names, which already shows a form of disparity. This may confuse readers when they read one journal to the next. An open-access journal like *PNAS* calls the lay summary a “significance statement” while *PLOS Biology* refers to it as an “author summary.”²¹ Another disparity arises as there are inconsistencies in the length and inclusion criteria of lay summaries Organizations such as the UK Research Council, The Stroke Association, and the British Heart Foundation each use lay summaries to convey research to the public but have varying guidelines in terms of length.¹⁸ The UK Research Councils permits 600-1000 words, the Stroke Association permits 1,000 words, and the British Heart Foundation permits 100 words.¹⁸

The Current Study

Due to the lack of consensus among journals and the lack of exploration in the field of science communication with regards to lay summaries, this research study will explore the level of accessibility and effectivity of various lay summaries in four open-access journals:

PLOS Medicine, *Proceedings of the National Academy of Sciences (PNAS) of the United States of America*, *SAGE Open*, and *Frontiers in Psychology*.

PLOS Medicine is a peer-reviewed journal which covers a wide scope of medical sciences, and has an impact factor of 11.07 as of 2020.¹² This journal refers to the lay summary as the lay abstract, and instructs to avoid jargon, maintain a word count of 300-500 words, and ensure the summary is concise and accessible. It provides a breakdown of the individual components required for inclusion.¹² *PNAS* is a multidisciplinary, peer-reviewed scientific journal with an impact factor of 11.20 as of 2020.¹⁹ This journal refers to the lay summary as the significance statement and instructs to explain the significance of the research within 120 words.¹² *Sage Open* is a peer-reviewed journal reared around the behavioural and social sciences, and has an impact factor of 1.356 as of 2021-2022.¹⁵ This journal refers to the lay summary as the lay abstract, and instructs for it to be written in 150 words and address the purpose and accuracy of the individual manuscript components.¹⁵ *Frontiers in Psychology* is a peer-reviewed journal that covers a broad scope of psychology aspects, and has an impact factor of 2.99 as of 2020.² This journal refers to the lay summary as the lay abstract, and instructs writers to convey the overall significance in an accessible manner.²

We hypothesized that each of the four journals will differ greatly in the scores they receive due to a lack of consensus among guidelines provided to authors. Investigating this topic of research will grant an understanding of the current guidelines provided by these journals, and whether such plays a role in the efficacy and accessibility of lay summaries at communicating scientific discovery.

METHODS

This study analyzed a total of 20 lay summaries among four different open-access journals. Journals were considered open-access if the journal description mentioned that, and/or if the article was available to view without a pay wall, login credentials, or any sort of subscription. Five lay summaries were analyzed from each of the four journals, *PLOS Medicine*, *Proceedings of the National Academy of Sciences (PNAS) of the United States of America*, *SAGE Open*, and *Frontiers in Psychology*. Articles were chosen from the most recent issue tab/current issue tab on each journal website. The first five articles that appeared were selected and the lay summary (otherwise called significance statement or inclusive summary) were analyzed.

Summaries were graded based on the LIFESCI 2AA3 rubric (Appendix Figure A) that was created by Dr. Katie Moisse, assistant professor of curriculum and

pedagogy at McMaster University, School of Interdisciplinary Science. This rubric was used as it includes key characteristics that an accessible lay summary should have. This rubric entails four sections, each worth five marks, leading to a total score out of 20. The first section of the rubric focuses on the degree at which the study methods, results, and conclusions were accurately summarized. The second section focuses on the degree at which the study rationale, implications, and limitations were summarized. The third section focuses on the level of clarity and organization of the summary overall. The last section focuses on the level of accessibility, particularly whether the writing was tailored towards a general audience.

Raw data was inputted into a Microsoft Excel spreadsheet as seen in Appendix Figure B. Using a statistical software called Prism 9 GraphPad, a one-way ANOVA test was conducted between each journal's lay summary scores to determine whether there was a significant difference in scores between each journal. A one-way ANOVA test was also conducted on the journal scores for each criterion individually. Figures were created on Prism 9 – GraphPad.

RESULTS

To compare the effectiveness and accessibility of each journal, the five lay summary scores for each journal were compared as seen in Figure 1.

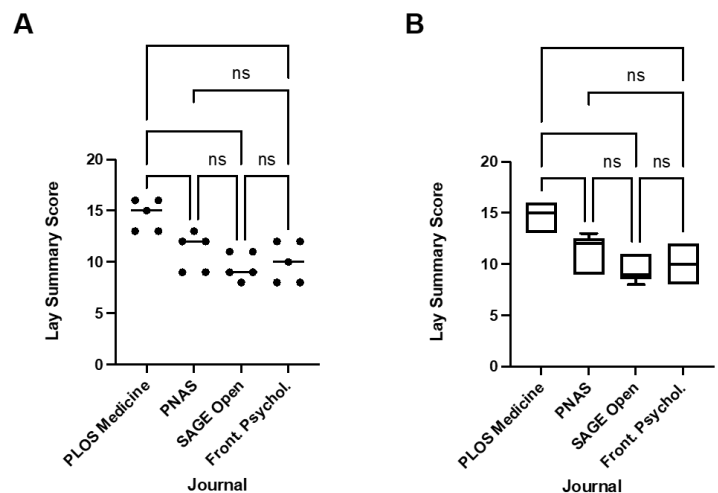


Figure 1. Lay summary scores for five summaries each in four open-access journals based on the LIFESCI 2AA3 rubric. A – Individual scores for five lay summaries are displayed for each journal via scatter plot ($n = 4$). One point on the graph represents the score out of 20 for one lay summary. The horizontal line represents the median score for each journal. Statistical significance is displayed via asterisks, with one asterisk representing lower significance ($p \leq 0.05$) and three asterisks representing greater sig-

nificance ($p \leq 0.001$). No statistical significance is represented by “ns.” B – Lay summary scores for each journal are displayed via box plots ($n = 4$). Error bars represent standard deviation. In both graphs, *Frontiers in Psychology* is abbreviated to *Front. Psychol.* for simplicity.

Figure 1 compares the scores between the four journals. *PLOS Medicine* ranked highest with an average score of 14.6, *PNAS* ranked second with an average score of 11, *Frontiers in Psychology* ranked third with an average score of 10, and *SAGE Open* ranked last with an average score of 9.6. Scores are statistically significant between *PLOS Medicine* and *PNAS*, *SAGE Open*, and *Frontiers in Psychology*, with $p = 0.0194$, $p = 0.0014$, and $p = 0.0030$ respectively. Based on the p -values, greater statistical significance exists between *PLOS Medicine* and *Frontiers in Psychology*, with even greater statistical significance between *PLOS Medicine* and *SAGE Open*. No statistical significance exists between *PNAS* and *SAGE Open*, *PNAS* and *Frontiers in Psychology*, and *SAGE Open* and *Frontiers in Psychology*.

To compare how each journal ranked for the individual criteria from the LIFESCI 2AA3 lay summary rubric, raw data were graphed as depicted in Figures 2 and 3.

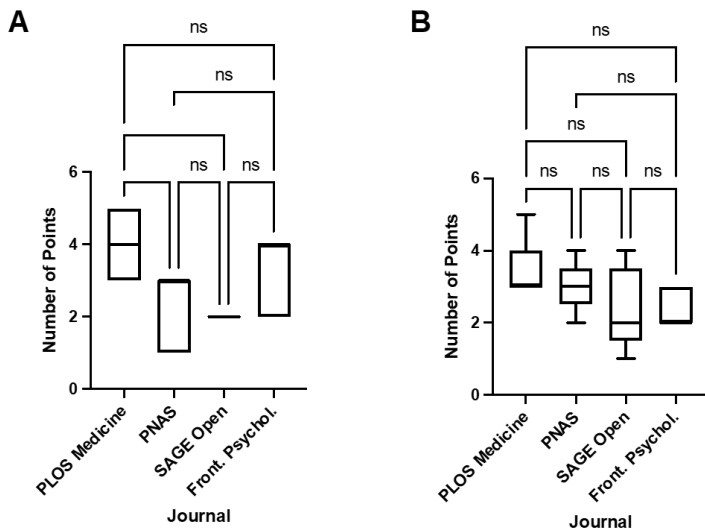


Figure 2. Lay summary scores for each journal based on criteria 1 and 2 from the LIFESCI 2AA3 rubric. A – Lay summary scores for criteria 1 on the rubric ($n = 5$). Standard deviation bars not evident. B – Lay summary scores for criteria 2 on the rubric ($n = 5$). Error bars represent standard deviation. In both graphs, *Frontiers in Psychology* is abbreviated to *Front. Psychol.* for simplicity. All scores are out of five. Statistical significance is displayed via asterisks. No statistical significance is represented by “ns.”

Criteria 1 and 2 focus on how the different components of the article were summarized. For criteria 1, *PLOS Medicine* scored the highest with an average of 4 points, *Frontiers in Psychology* ranked second with an

average of 3.2 points, *PNAS* ranked third with an average of 2.2 points, and *SAGE Open* ranked the lowest with an average of 2 points. Scores are statistically significant between *PLOS Medicine* and *PNAS*, and between *PLOS Medicine* and *SAGE Open*, with $p = 0.0322$ and $p = 0.0163$ respectively. No statistical significance exists between all other journal pairings. For criteria 2, *PLOS Medicine* scored the highest with an average of 3.4 points, *PNAS* ranked second with an average of 3 points, with *Frontiers in Psychology* and *SAGE Open* scoring the lowest with an average of 2.4 points. Scores are not statistically significant between any of the journals.

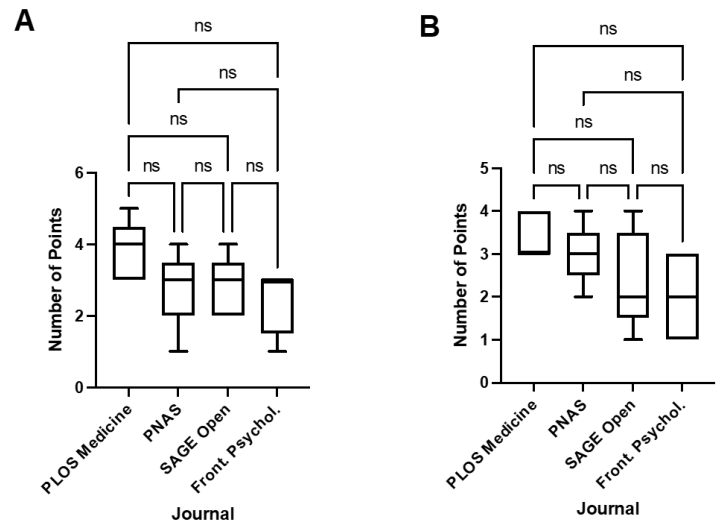


Figure 3. Lay summary scores for each journal based on criteria 3 and 4 from the LIFESCI 2AA3 rubric. A – Lay summary scores for criteria 3 on the rubric ($n = 5$). Error bars represent standard deviation. B – Lay summary scores for criteria 4 on the rubric ($n = 5$). Error bars represent standard deviation. In both graphs, *Frontiers in Psychology* is abbreviated to *Front. Psychol.* for simplicity. All scores are out of five. No statistical significance is represented by “ns.”

Criteria 3 and 4 focus on overall flow and accessibility. For criteria 3, *PLOS Medicine* scored the highest with an average of 3.4 points, *PNAS* and *SAGE Open* tied for second with an average of 2.8 points, and *Frontiers in Psychology* ranked the lowest with an average of 2.4 points. Scores are not statistically significant between any of the journals. For criteria 4, *PLOS Medicine* scored the highest with an average of 3.4 points, *PNAS* ranked second with an average of 3 points, *SAGE Open* ranked third with an average of 2.4 points, and *Frontiers in Psychology* ranked the lowest with an average of 2 points. Scores are not statistically significant between any of the journals.

DISCUSSION

This study analyzed the effectiveness and accessibility of lay summaries across four open-access journals using the LIFESCI 2AA3 rubric. The results conclude that *PLOS Medicine* ranked the highest for all criteria analyzed, while *SAGE Open* typically ranked on the lower end of the scale. This conclusion may be attributed to the varying guidelines proposed by the individual journals. *PLOS Medicine*'s impact factor is 11.07 as of 2020, which is quite high on the spectrum compared to *Frontiers in Psychology* and *SAGE Open* which each have impact factors below 3.^{11,14,15} The author guidelines for this journal mention that any submitted writing should avoid jargon and should be concise and accessible for readers who are not experts in the field, or for those who don't speak English as a first language.¹² The guidelines mention that editors assist with the process to ensure conciseness and accessibility, and that an initial evaluation is conducted for peer review. This requirement may explain *PLOS Medicine*'s significantly higher overall average compared to the other three journals, as seen in Figure 1. In terms of specific lay summary guidelines, the journal mentions a word count (300-500 words), the individual sections that are required (background, methods, and conclusions), and information pertaining to each section. The guidelines mention that background information including rationale and study objects should be mentioned, which may contribute to *PLOS Medicine*'s slightly higher average for criteria 2 in Figure 2, compared to the other journals. The methods and findings guidelines instruct for a description of study participants, design, intervention, analysis, outcomes, and limitations, which are clear guidelines for what is expected, and thus may attribute to *PLOS Medicine*'s significantly higher score for criteria 1, as seen in Figure 2. For criteria 3 and 4, given that clear guidelines were provided and the guidelines instructed to avoid jargon, this may have contributed to the higher average for *PLOS Medicine* as seen in Figure 3.¹²

PNAS has a slightly higher impact factor of 11.20 as of 2020, and claims to publish largely cited research, alongside offering professional editing and exceptional peer review.¹³ This journal refers to the lay summary as a significance statement, and its guidelines are only two sentences. The guidelines mention that the statement should be a maximum of 120 words and explain the significance while being "understandable to an undergraduate-educated scientist."¹⁹ Considering undergraduate scientists are not a lay person and have varying knowledge on scientific topics already, this may attribute to the scientific jargon found in lay summaries. The guidelines are brief and do not make reference to any specific components, such as background information, methods, or results, which may explain why the journal did not score on the higher end (i.e. four or

five points) for criteria 1 and 2. The guidelines do not advise to refrain from using jargon, which may attribute to why *PNAS* scored significantly lower in Figure 1 when comparing to *PLOS Medicine*, a journal whose guidelines mention avoiding jargon. Given that criteria 1 is focused on the methods, results, and conclusions, this tends to be the most jargon-heavy portion of the summary, so without guidelines on jargon, a low score is expected from *PNAS*. *PNAS* also caters to a scientific audience over a lay audience, which may also explain this result. This journal's guidelines mention that manuscripts do not need to be formatted in a specific manner/according to any specific guidelines during the initial submission, which may reason for why *PNAS* scored on the lower end (average of 2.8 points) for criteria 3, a criterion that focuses on the overall organization and clarity of the manuscript. The journal guidelines mention that laboratory jargon should be avoided and that abbreviations should be defined in the main text, but there is no mention of this for the lay summary.¹⁹ This may attribute to why *PNAS* scored an average of 3 points for criteria 4, a criterion focused on accessibility, rather than scoring on the higher end (4 to 5 points).

Frontiers in Psychology has an impact factor of 2.99 as of 2020, which is on the lower end of the spectrum.¹⁴ The journal guidelines refer to the lay summary as the lay abstract and mention very briefly that the general significance of the research should be conveyed, it should be "clearly accessible to a broad readership," and that abbreviations should be limited.¹ Aside from the fact that the journal guidelines as a whole are very vague, "accessible" and "broad readership" are not defined. It is unclear as to whether "accessible" means that it should be easy to access on the Internet based on the article title, or whether it means that it should be easy to understand by a lay audience. Authors submitting their manuscripts may find this guideline unclear, which is reflected in criteria 4, a criterion focused on accessibility, in which *Frontiers in Psychology* ranked lowest on. The guidelines mention a "broad readership" which to some researchers may mean someone who is knowledgeable in many fields, and to others, someone who is not knowledgeable in any field. The level of "lay" is not understood here, which impacts criteria 4. The guidelines do not mention any specifics as to which sections are required in the lay abstract, which may attribute to the fairly low score for criteria 2 (study rationale, implications, and limitations) but higher score for criteria 1 (methods, results, and conclusions). Researchers may believe that the methods, results, and conclusions are the most important part of the abstract, so without specific guidelines, they may neglect the study rationale, limitations, and implications, and focus solely on the methods, results, and conclusions, thus leading to the scores seen in Figure 2. The guidelines also do not mention a word count which may attribute to the fairly low score for criteria 3, a criterion focused on

overall clarity and organization.¹ Without a strict word count, researchers may include too much or too little information, thereby impacting clarity.

As of 2020-2021, *SAGE Open* has an impact factor of 1.356, the lowest amongst the four journals.¹⁵ The manuscripts published to this journal are peer-reviewed by two experts, but the process differs from the traditional approach such that *SAGE Open* places more emphasis on the accuracy of the research methodology, results, and conclusion.⁹ This takes focus off of summarization and accessibility, which may attribute to why *SAGE Open* scored significantly lower on criteria 1 and 2 compared to *PLOS Medicine*, and on the lower end for criteria 4. The guidelines place a heavy focus on making articles discoverable and advises for discoverable titles and abstracts. This emphasizes gaining publicity, and as such, manuscripts published in this journal may not be targeted towards a lay audience, explaining the low score for criteria 4, a criterion focused on accessibility. The specific abstract guidelines do provide a word count, which may attribute to why *SAGE Open* tied for second for criteria 3, a criterion focused on organization and clarity. A strict word count may make the research more concise and only focus on important details, thus enhancing the clarity of the summary. The journal guidelines mention which sections to include (purpose, methods, results, and conclusions), but does not provide any specifics on what each section entails, like *PLOS Medicine* does.⁸ This is reflected in Figure 2, as *SAGE Open* scored lowest for criteria 1 and 2, both of which are criteria reared around the individual components of the lay summary.

Overall, it is evident that *PLOS Medicine* scored highest on all criteria. When comparing *PLOS Medicine* to the three other journals, there is a substantial difference in the amount of information provided on the author guidelines page. A key reason for this may be because *PLOS Medicine* is the only journal that explicitly states to avoid jargon, while the three other journals do not explicitly mention such. Another reason for this may be because *PLOS Medicine* is the only journal that breaks down the individual components of the summary (background information, methods, results, conclusions) while also providing further instructions for each individual section. A third reason for *PLOS Medicine*'s significantly higher ranking may be because this journal is the only journal whose guidelines mention limitations and future implications, which is one of the criteria on the rubric. Many researchers may find this information irrelevant to mention in the lay summary, and without any guidelines on it, will likely disregard including it at all.

Although the results in this study are promising, there were some limitations. A limitation of this study is that there was an insufficient sample size due to time con-

straints. Given that only 20 lay summaries were analyzed, there is not enough data to generalize the results and conclusions of this study to each individual journal, and a smaller sample size decreases statistical power. Another limitation is that there was only one grader for the summaries, so the study lacks interrater reliability. This may bias the study as all of the data and results are based solely on one individuals' interpretation. The rater's status, as an undergraduate student in science, differs widely from a lay person, and may influence what is considered jargon and what is not. A third limitation of this study may come from the selection of articles from each journal. There was no way to control for the type of subject area that was of focus for each article. For example, one journal may have five, very heavy, biology-based articles in their recent issue, while another journal may have articles focusing on climate change in their recent issue. The climate change articles are likely more accessible and easier to understand by a lay audience, simply because of the subject at hand. This may bias the results as there was no control measure for the type of subject, but rather articles were picked at random, providing an unfair advantage to some journals over the other. Another limitation is that only the first five articles from each journal were analyzed, which disregards older lay summaries that could have been better/worse, and skewed the results accordingly.

The LIFESCI 2AA3 rubric may also have some limitations within it. The rubric does not provide specific instructions on specific components to look for and what is considered "accurately summarize." Some raters may assume this means to concisely describe the study, some may assume it means to correctly describe the study, and some may assume both. There is also ambiguity in terms of how the comments for 2 points and 3 points differ on the rubric for criteria 1 and 2 as they both sound quite similar and revolve around the same idea of confusion. As such, different raters may assign points differently. Lastly, the rubric does not explicitly state to look for jargon, although this is where a lot of the issues with inaccessible lay summaries stems from.

Next steps include reproducing this study with more journals and more lay summaries from each journal. This will make the conclusions of the study more generalizable to the journal and provide guidance to the journal in terms of how the author guidelines should be changed to enhance effectiveness and accessibility of lay summaries. Another next step is to impose a cohesive set of guidelines for constructing these lay summaries universally between all journals. This will assist in sustaining the level of open-accessibility that a journal displays, while also making it easier for readers to follow and understand. Lastly, all researchers who plan to publish a manuscript in any open-access journal should be required to attend a set number of sci-

ence communication workshops, in order to fully demonstrate their understanding of accessibility and effectivity with regard to lay summaries. The LIFESCI 2AA3 rubric used in the study could also be tweaked slightly to add some clarity. For instance, there could be more specifics on each individual section such as the methods, which could be further broken down into study participant criteria, the type of study, and the intervention. There should also be a section on the rubric that explicitly states that jargon is avoided in the summary, as this is the root cause of inaccessible lay summaries.

CONCLUSION

The main findings of this study suggest that there are differences in the effectiveness and accessibility of lay summaries between different open-access journals. This disparity may be attributed to varying guidelines provided by each journal to authors creating these lay summaries for public dissemination. Consistency between journal guidelines as well as the incorporation of specific guidelines against scientific jargon may help improve the cohesiveness, quality, and accessibility of lay summaries amongst open-access journals.

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ARTICLE INFORMATION

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APPENDIX

Content	Level 5 5 points	Level 4 4 points	Level 3 3 points	Level 2 2 points	Level 1 1 point	Criterion Score
Did you accurately summarize the study methods, results and conclusions?	You excelled at this task, providing information that was consistently on-point.	Your summary is mostly accurate but sometimes ambiguous.	Your summary is mostly accurate but incomplete, introducing the potential for confusion.	Your summary raises multiple questions or lacks focus and was difficult to unpack.	Your summary contains multiple inaccuracies.	/ 5
Did you accurately summarize the study rationale, implications and limitations?	You excelled at this task, providing information that was consistently on-point.	Your summary is mostly accurate but sometimes ambiguous.	Your summary is mostly accurate but incomplete, introducing the potential for confusion.	Your summary raises multiple questions or lacks focus and was difficult to unpack.	Your summary is off-point.	/ 5
Style	Level 5 5 points	Level 4 4 points	Level 3 3 points	Level 2 2 points	Level 1 1 point	Criterion Score
Is your writing clear, clear and logically organized?	Your writing is free of typos and grammatical errors and easy to follow, with smooth transitions that carry your reader from one thought to the next.	Your writing is clean and your sentences are strong, but the overall organization could be improved.	Your writing contains one typo, grammatical error, confusing sentence or awkward transition or it lacks some clarity in terms of sentence structure and organization.	Your writing contains more than one typo, grammatical error, confusing sentence or awkward transition.	Your writing has multiple mistakes or minimal flow.	/ 5
Is your writing tailored to its audience and purpose?	Your writing is a joy to read, you make complex concepts relatable and consider your audience from start to finish, in terms of the language you use and the organization of your thoughts.	Your writing is accessible and contains elements that will engage your audience.	Your writing is generally accessible and contains at least one element aimed at engaging your audience, but some parts fall flat.	Your writing is generally accessible but it lacks elements that will engage your audience and keep them reading from start to finish.	Your writing contains words or descriptions that are inaccessible to your audience or may bore them.	/ 5
Total						/ 20

Figure A. LIFESCI 2AA3 rubric for lay summaries.

Journal Name	Lay Summary #	Criterion 1	Criterion 2	Criterion 3	Criterion 4	Total /20	Average
PLOS Medicine	Lay 1	3	5	5	3	16	14.6
	Lay 2	5	3	4	4	16	
	Lay 3	5	3	3	4	15	
	Lay 4	4	3	3	3	13	
	Lay 5	3	3	4	3	13	
PNAS	Lay 6	3	3	3	3	12	11
	Lay 7	3	2	1	3	9	
	Lay 8	1	3	3	2	9	
	Lay 9	3	4	3	3	13	
	Lay 10	1	3	4	4	12	
SAGE Open	Lay 11	2	2	3	4	11	9.6
	Lay 12	2	4	2	3	11	
	Lay 13	2	2	3	2	9	
	Lay 14	2	1	4	1	8	
	Lay 15	2	3	2	2	9	
Frontiers in Psychology	Lay 16	4	2	3	3	12	10
	Lay 17	2	3	2	1	8	
	Lay 18	2	3	1	2	8	
	Lay 19	4	2	3	1	10	
	Lay 20	4	2	3	3	12	
	Total	57	56	59	54	226	
	% out of 100 points	0.57	0.56	0.59	0.54		

Figure B. Raw lay summary scores for each journal based on the criteria listed on the LIFESCI 2AA3 rubric