

Opioid Epidemic Policy: Predictive Power of Collaborative Quantity vs. Quality in Determining Impactful Research

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Abstract

Scientific research and literature have an important role in determining effective public health policy, especially in regards to the global health issue of opioid addiction, where a multifaceted approach is necessary. In many cases, public health researchers aim to reach a wide audience not only to inform and guide policy makers, but also to educate the general public. Although parameters such as citation count have been a valid measure for the impact of a paper, it is unclear whether the types of collaborations a writer partakes in influence the impact of their paper. In this study, research papers on opioid substitutions were analyzed to evaluate the relationship between citation count and different types of collaborations, which include author count, affiliation count, author prestige, and affiliation prestige. Results showed no significant correlation between citation count and any of the variables. In terms of an author's collaborations, both the number of collaborators and the prestige of those collaborators are not major factors in determining the impact of a research paper about opioid substitutes. Other possible factors, like citation or publication biases, could play more central roles in determining research impact.

Keywords

Bibliometric, OST (Opioid Substitution Therapy), Opioid Epidemic Policy

1. Introduction

Since the introduction of opioid medications, medical professionals have utilized

the drugs to treat pain-related illnesses. However, misuse has also become a problem that is escalating globally. Opioid misuse has been recognized by the World Health Organization (WHO) as the beginning of the opioid epidemic. Contributing factors such as a lack of awareness regarding the risks of opioid addiction, widespread misinformation, and aggressive marketing have led many individuals to develop opioid use disorders (OUDs) [1].

To address opioid dependence, opioid substitution therapy (OST) has emerged as a common treatment. This therapy aims to reduce illicit drug use by replacing it with medically prescribed opiates [2]. The approach helps to alleviate withdrawal symptoms, reduce overdose risk, and is associated with higher retention rates in treatment programs. However, despite its significant benefits, OST faces challenges such as potential misuse and limited accessibility, which hinder its full potential [3].

In general, influential papers can affect policy-making and inform the public on effective health strategies. One research study aimed to assess the extent of existing academic articles related to the epidemic of prescription opioid deaths and found that they finally became noticeable ten years following the start of the epidemic (1993-1997) [4]. Other existing literature related to “opioids” and “immunomodulation” has been searched for from the Web of Science Core Collection database in a previous bibliometric study [5]. Although the study aimed to provide a more comprehensive analysis of the global research trends related to opioids within the last two decades, there are still very few studies using the bibliometric approach. This poses a concern with how to effectively study trends and discover better ways to broaden the impact and reach of these papers. While factors such as citation count have been studied, the roles of author collaborations and affiliations in affecting the reach and impact of a paper regarding opioid substitutes have yet to be extensively explored. Especially due to the evidence-based nature of opioid research and policies, it is important to determine the factors that could affect a paper’s reach and to possibly identify potential biases.

Our paper explores the current landscape of opioid research literature. Four independent variables will be examined: total collaborating authors, total collaborating institutions, mean author prestige, and mean institution prestige. This analysis aims to determine the extent to which bibliometrics measures the impact of opioid research. With this, we hope to determine the value of strategically choosing the nature of authorship within the field of opioid research, thus advancing knowledge, guiding policy based on research trends, and clinical practice within this critical area.

2. Methods

The bibliometrics data were collected from the Web of Science (WoS) and querying “opioid AND (substitute OR substitution).” These query terms were chosen to target relevant studies that focus on a key strategy to treating opioid misuse. To measure author prestige, an author’s *h*-index (number of published papers *h*

where each paper has received at least h citations) was used. The h -index was used to reduce bias from extreme values. In determining institution prestige, data were pulled from the 2024 QS World University Rankings, specifically the Academic Reputation scores. Using a third-party ranking company has the benefits of the holistic evaluation of institutions and takes into consideration reputation and perception while minimizing possible bias. QS Academic Reputation score was chosen over other institutional metrics since it reflects peer assessments of institution quality at a global scale. Unlike other metrics, such as employer reputation or student-faculty ratio, reputation score represents the general consensus of the institution, making it a viable proxy for affiliation prestige.

The relationships between citation count, author/affiliation count, author prestige, and affiliation prestige were measured for three different disciplines: Chemistry & Biology, Medical Sciences, and Social Sciences.

LOESS regression was chosen to represent the non-parametric data, which proved to be a good fit based on diagnostics and testing.

3. Procedures

On WoS, the query “opioid AND (substitute OR substitution)” was used, yielding 3876 results at the time of data collection. The dataset was filtered to include only records with the document type “article” and publication years between 1976 and July 2, 2024. Results were exported as BibTex files, and full record and cited references were chosen for record content. Bibliometrics data, including citation count, was downloaded on July 2, 2024. Papers listing a consortium or corporate author were excluded. For author count, only authors individually named were included. Regarding h -index calculations, consortiums and corporate entities do not have individual writing histories, excluding them from h -index calculations.

The QS Rankings data were cleaned by only including institution name and academic ranking score. To normalize the names of the institutions, excess punctuation was removed and words were shortened. For example, the word “university” was shortened to “univ.” Author h -index was calculated using Python 3.12 and was used to measure author prestige.

Afterwards, the research was binned into the aforementioned disciplines and used prefixes that were associated with each field in order to filter the WoS data and compare the impact of research across the fields. Prefixes such as “BIO” and “CHEM” were used to bin into Chemistry & Biology, “MED” and “PAIN” for Medical Sciences, and “PSYCH” and “ABUSE” for Social Sciences. Prefixes were chosen keeping in mind common and relevant terms among each discipline.

Then, the data were put into a table with labeled columns, and unneeded variables such as author name were discarded. Author and affiliation count were calculated. Values were imputed to author and affiliation prestige. LOESS models were created in RStudio for each variable in all categories, and the residuals were tested.

4. Results

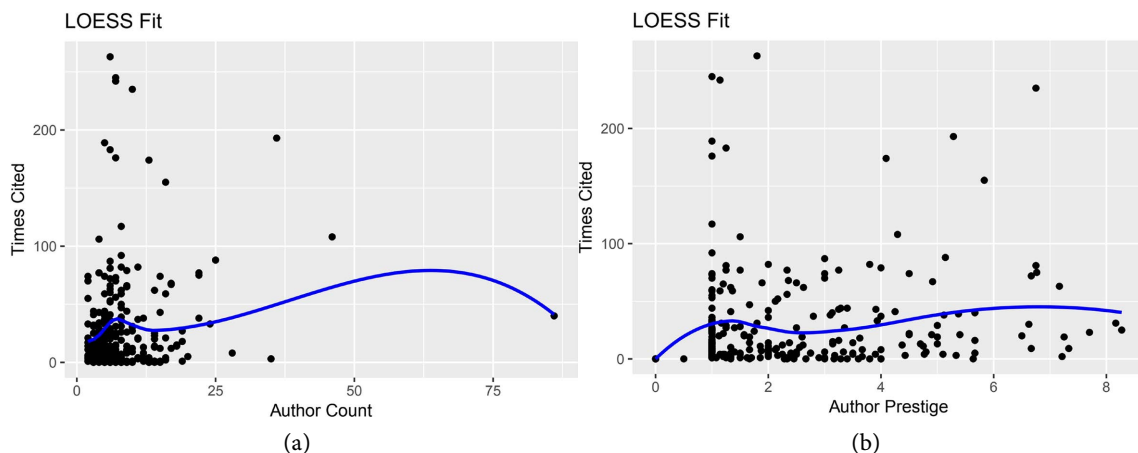
The data collected on OST research papers was organized into three categories:

biological and chemical sciences, medical sciences, and social science. The LOESS span parameter was 0.5, and the histogram of residuals for all plots were centered around 0, indicating good fit. Across all three categories, author count/affiliation count had no obvious correlation with times cited and exhibited right skewness. Author count in the biological and chemical sciences category ranged from 2 to 86 collaborators (see **Figure 1(a)**) while the other categories greatly differed with medical sciences ranging from 2 to 26 collaborators (see **Figure 2(a)**) and social sciences ranging from 2 to 42 collaborators (see **Figure 3(a)**). In contrast, affiliation count shown in **Figure 1(c)**, **Figure 2(c)**, and **Figure 3(c)** had noticeably smaller ranges, further supporting the absence of a strong correlation between author count/affiliation count and times cited.

When analyzing author prestige/affiliation prestige, there is no obvious correlation between the variables. This is consistent in the data across all categories. Furthermore, the correlation between author prestige and number of times cited exhibited a right skewed graph for all categories (see **Figure 1(b)**, **Figure 2(b)**, **Figure 3(b)**). Affiliation prestige and number of times cited demonstrated a uniform distribution for all categories (see **Figure 1(d)**, **Figure 2(d)**, **Figure 3(d)**). In **Figure 1(b)** and **Figure 1(d)**, LOESS plots for author prestige/affiliation prestige in the biological and chemical sciences category plateau at around the top 25% of the sample. In **Figure 3(b)** and **Figure 3(d)**, LOESS plots for author prestige/affiliation prestige in the social sciences category plateau at around the top 87.5% of the sample. In **Figure 2(b)** and **Figure 2(d)**, the medical sciences category displayed an upward trend for author prestige but there is a presence of outliers. The relationship between affiliation prestige and times cited in the medical science category plateau at around the top 37.5%.

5. Discussion

The purpose of our research is to analyze the influence of author prestige, affiliation prestige, author count and affiliation count on research impact. By understanding the extent of the impact that author and affiliation prestige has on research significance, the findings can be used to inform researchers about how to



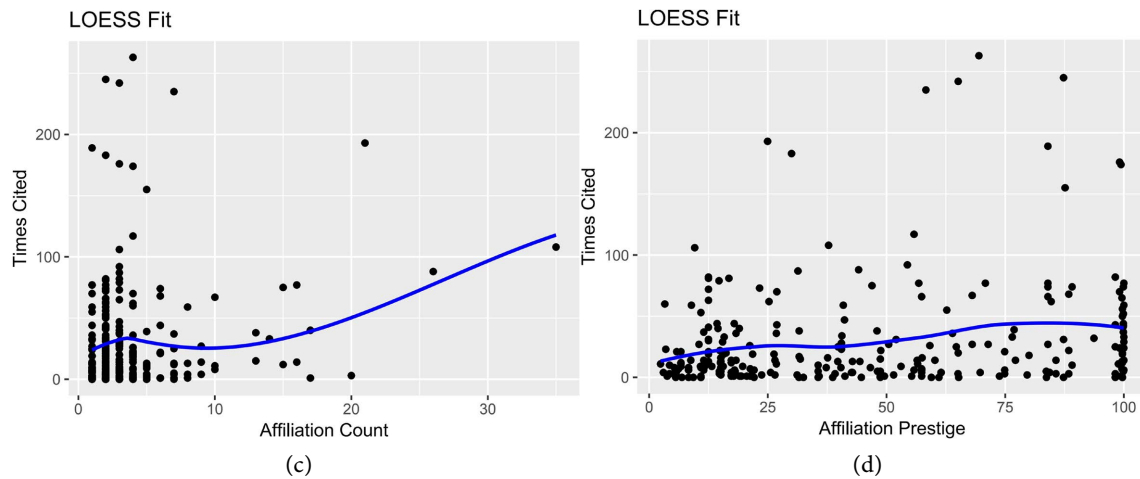


Figure 1. LOESS plot for OST papers relating to chemical and biological sciences. Each plot graphs the relationship between author count and times cited (range 2 - 86, median = 6, mean = 8.37 +/- 7.64) (a), author prestige and times cited (range 0 - 8.27, median = 1.86, mean = 2.45 +/- 1.78) (b), affiliation count and times cited (range 1 - 35, median = 3, mean = 3.86 +/- 4.10) (c), and affiliation prestige and time cited (range 2.4 - 100, median = 40.40, mean = 45.93 +/- 32.80) (d).

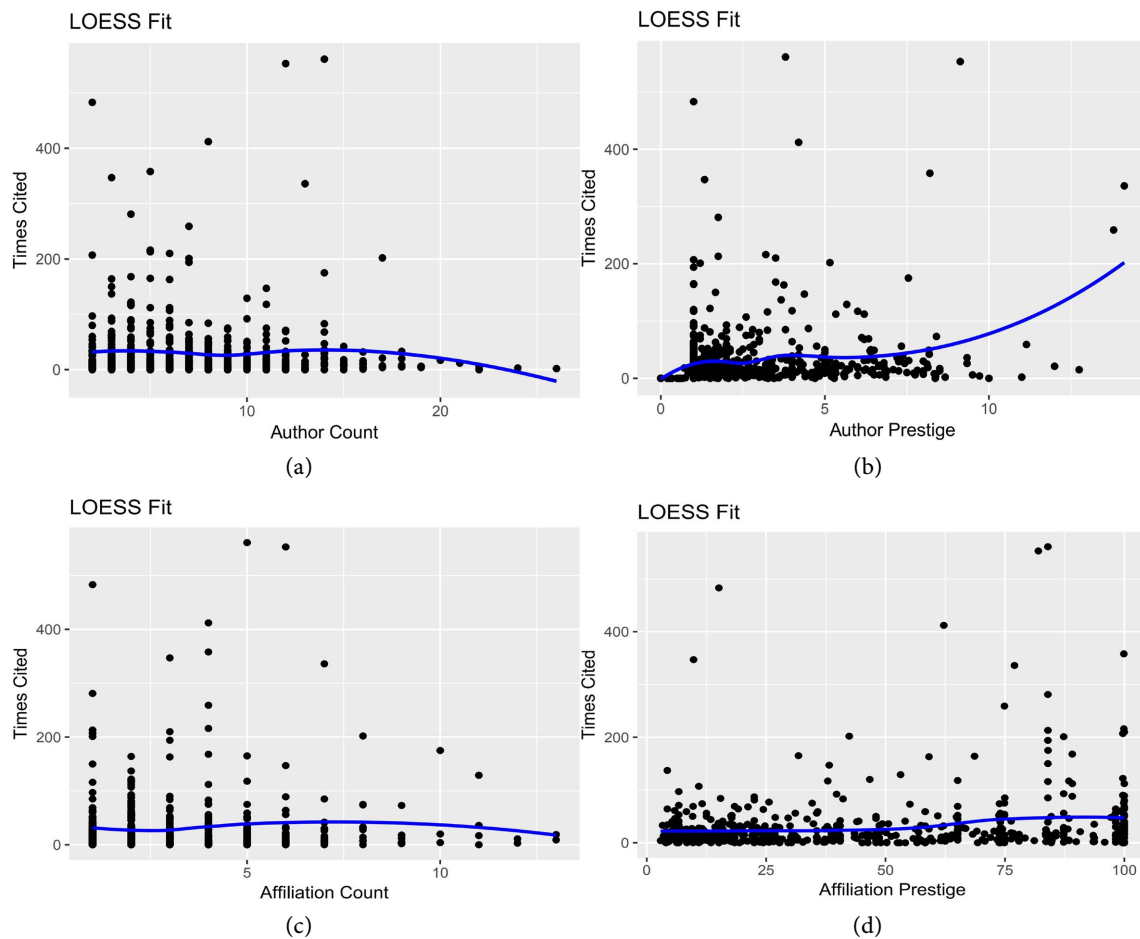


Figure 2. LOESS plot for OST papers relating to medical sciences. Each plot graphs the relationship between author count and times cited (range 2 - 26, median = 6, mean = 7.14 +/- 4.10) (a), author prestige and times cited (range 0 - 14.12, median = 1.75, mean = 2.78 +/- 2.35) (b), affiliation count and times cited (range 1 - 13, median = 3, mean = 3.12 +/- 2.12) (c), and affiliation prestige and time cited (range 2.9 - 100, median = 37.77, mean = 44.70 +/- 32.93) (d).

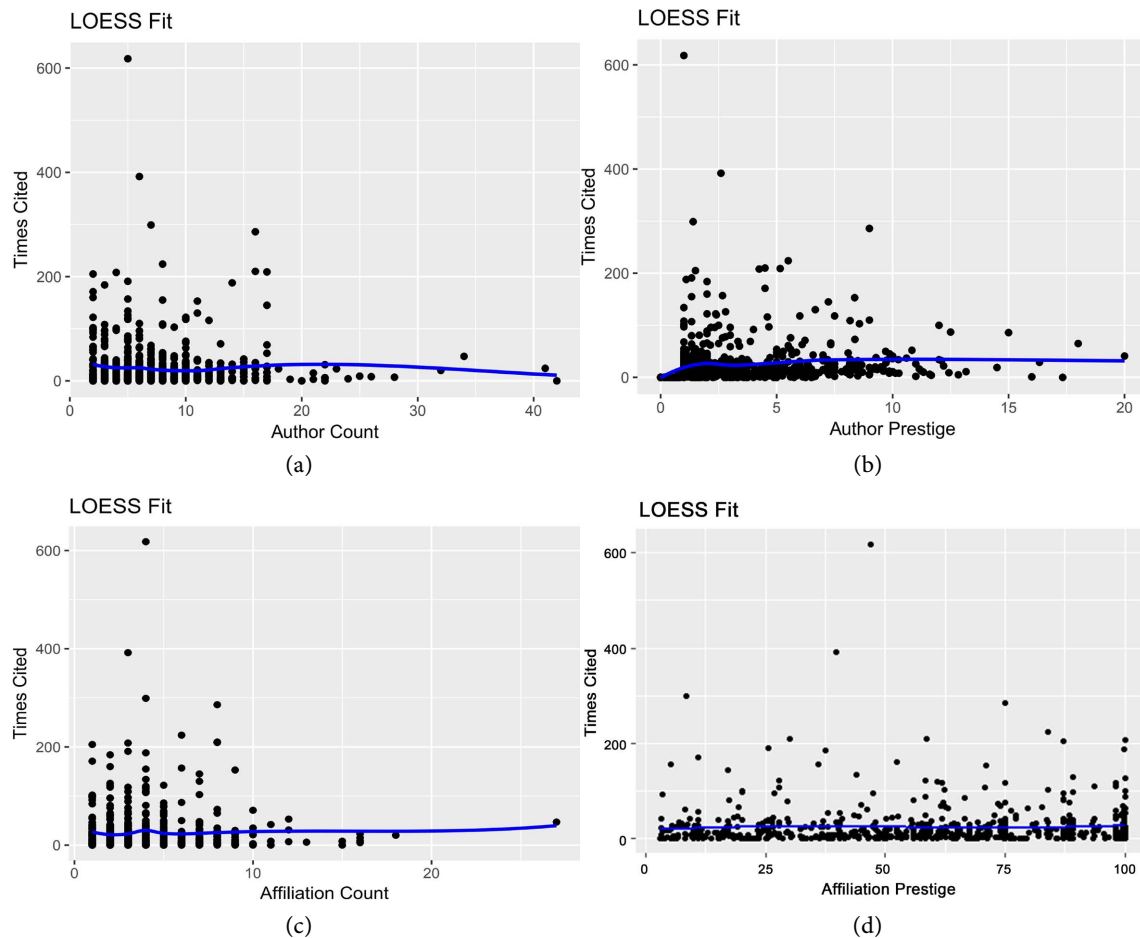


Figure 3. LOESS plot for OST papers relating to social sciences. Each plot graphs the relationship between author count and times cited (range 2 - 42, median = 6, mean = 7.350 \pm 4.71) (a), author prestige and times cited (range 0 - 20, median = 2, mean = 3.29 \pm 3.02) (b), affiliation count and times cited (range 1 - 27, median = 3, mean = 4.00 \pm 2.62) (c), and affiliation prestige and time cited (range 2.9 - 100, median = 61.70, mean = 59.07 \pm 30.25) (d).

maximize the impression of their publications. Despite the number of studies being conducted constantly, there is a huge proportion of lost work due to the lack of citations and acknowledgement of most research papers. In the deep extensive network of research, there can be many findings that pose a huge advantage in progression for medicines, treatments, clinical studies. The only issue is that some publications will not have as strong of an impact as other findings are, which is why bibliometric analysis is highly important for knowing which research methods to implement for maximum efficacy.

The results of this study demonstrated no significant correlation between any of the variables. In the chemical and biological sciences category, the LOESS plot of both author count and affiliation count exhibited a right skewed graph with a positive correlation between the variables and number of times cited (see **Figure 1**). For author count, there exists only one point on the plot in which author count is >75 authors. Similarly, in affiliation count, there exists three points in which affiliation count >20 institutions and only one point where affiliation count is >30

institutions. This phenomenon can likewise be observed in the medical sciences category for author prestige (see **Figure 2**). The presence of these outliers and small sample sizes contributed to the decision to use a LOESS fit for the data instead of a linear regression model. The LOESS fit allows us to better visualize the data and account for the effect of outliers.

5.1. Limitations of the Study

Some limitations of this study should be noted. The sample size may have led to the high variability of the variables which required the use of a LOESS fit. A small sample size is less resistant to outliers and this can be observed by the right skewed graphs. While the LOESS plot minimizes some of the limitations presented when using linear regression, there are some limitations with using a LOESS fit to model data. Data modeled by a LOESS plot cannot be extrapolated and therefore we cannot predict values outside the range of the given data set. Furthermore, interpretation of the data is limited because there is no function for the relationship between variables—the fitted line changes due to the data points that are close to it. A possible solution to remove the influence of the presence of outliers other than using a LOESS plot is through influence testing and transforming data.

Another limitation is that each dependent variable was measured independently. Possible relationships between dependent variables, like author prestige and affiliation count, were not illustrated by the LOESS plot. For example, author prestige and affiliation prestige can be closely related and affect each other. To show these relationships and better understand the influence of these factors on research impact, multivariate statistical analyses could be used to model the data supplementary to the LOESS plots. Additionally, this study only considers four independent variables: author prestige, author count, affiliation prestige, affiliation count. Especially in OST, there may be other potentially important factors influencing research impact such as. The choice of variables may also not capture all relevant aspects across different disciplines within the OST field. With the consideration of the observed, other models can be explored in order to address non-linear relationships among variables to provide more insight.

A study displayed that differences in citation rates between the natural and social sciences stem from different methodologies and priorities of research [6], meaning that it may require more nuanced variables or sub-categorization to accurately capture the factors influencing research impact. Therefore, another limitation of the study is being unable to measure all the existing fields at once due to limited variables. Additionally, the study only considers four independent variables simultaneously. This limited number of variables may overlook other potentially important factors influencing research impact. The choice of variables may also not capture all relevant aspects across different disciplines within the OST field.

5.2. Interpretation of Results

Opioid substitution therapy is highly controversial in medicine. Health and social

care workers, in general, have been found to hold strongly negative attitudes toward patients with illicit substance use disorders [7]. This contributes to the lack of healthcare providers willing to prescribe OST. Additionally, despite the effectiveness of these drugs, there is a general cautiousness and skepticism of the use of OST. Due to the stigma surrounding the field, there is a lack of perceived research impact concerning these medications in respect to drug-based therapies in other fields. These factors inadvertently favor other fields of research over OST contributing to the lack of research in the field. In a study conducted by Akbar *et al.*, a bibliometric analysis illustrated a decline of citations in the research about opioids [8]. A decline of citations of opioid research papers is an indicator that research impact of OST may be declining if the stigma around it continues

Prior studies suggest that as more countries collaborate with each other, they are shown to relate to higher levels of research impact [9]. Evidently, this study has found that collaboration and prestige are not determining factors of research impact in the OST field. While the number of collaborators and prestige of an author or institution may have some influence on the type and quality of the research being done, our study has shown that research impact has no correlation between author/affiliation prestige and author/affiliation count. Furthermore, other factors, including the amount of funding for a project, are not included in the study and may play a larger role in determining the amount of research impact of a study. By addressing these limitations and implementing these suggestions, future bibliometric research in the OST field can aim for more comprehensive and accurate models that better capture the complexities of research impact determination across diverse disciplines.

6. Conclusion

Our bibliometric analysis on OST research papers demonstrated that there was no direct correlation with the impact of a research paper and the four variables we tested: the total collaborating authors, total number of collaborating institutions, mean author prestige, and mean institution prestige. While prior research displays that there was a higher correlation between scientific collaboration and citation count in two different subgroups than in other research domains [10], and that research from more prestigious institutions produces more publications because of greater access to labor resources [11], our findings suggest that these factors did not determine OST research effectiveness. Our limiting categories (social sciences, medical sciences, chemical and biological sciences) in the study constrained our results to broader categories that could have possibly prevented potential correlations in smaller sub-groups to be found, as well as the inability to extrapolate our data and the absence of a function of the variables relationship. Additionally, we did not take into account the amount of funding provided for each study nor consider the possibility of citation and publication biases. Despite these limitations, our research highlights that it is imperative for future researchers to discover what elements can maximize the efficiency and impact of OST research.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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