One hundred weeks of solitude: did the pandemic impact the scientific output of female researchers in three Mexican public research centers?

Chong-Carrillo, Olimpia[1,2]; Aréchiga-Palomera, Martín A.[2]; Chávez-Chong, Cristina O.[3]; Peña-Almaraz, Omar A.[2]; Nieves-Rodríguez, Karen N.[2]; Acosta-Altunaga, Michellet[2*]; Vega-Villasante, Fernando[2*]

[1] Estancias posdoctorales por México. Secretaría de Ciencia, Humanidades, Tecnología e Innovación (SECIHTI). Crédito Constructor. C. P. 03940. Benito Juárez, Ciudad de México, México.
[2] Laboratorio de Calidad de Agua y Acuicultura Experimental. Ixtapa. C. P. 48280. Puerto Vallarta, Jalisco, Mexico.
[3] Instituto de Cibernética, Matemática y Física. Ministerio de Ciencia, Tecnología y Medio Ambiente de Cuba. La Habana. C. P. 10400. Cuba.
* Correspondence: fvillasante@cuc.udg.mx; michelletacosta97@gmail.com

ABSTRACT

Objective: This study analyzes the evolution of scientific production by female researchers at three public research centers in Mexico (CIBNOR, CICESE, and CIAD) during the period 2014-2024, with an emphasis on the impact of the pandemic.

Design/methodology/approach: A bibliometric analysis was conducted based on the Scopus database, considering scientific articles, book chapters, and reviews.

Results: The overall results show that the pandemic did not cause a decline in output. An increase was observed at CIBNOR and CICESE, while CIAD experienced a decline in 2022 before recovering in 2024.

Limitations on study/implications: The study is restricted to the Scopus database, recognized for including the largest number of journals worldwide, although the omission of other databases could cause bias in the results. However, we consider that this limitation will not significantly affect the identified trends.

Findings/conclusions: This finding suggests that the impact of the pandemic on scientific productivity was not uniform and that institutional factors, adaptation strategies, and changes in funding and evaluation policies played a key role in the recovery. It is concluded that, although the overall trend was one of growth, the fluctuations observed reflect the complex interaction between external events, gender inequalities, and scientific policies.

Keywords: scientific articles, women, COVID-19, bibliometrics, gender equity.

Citation: Chong-Carrillo, O., Aréchiga-Palomera, M. A., Chávez-Chong, C. O., Peña-Almaraz, O. A., Nieves-Rodríguez, K. N., Acosta-Altunaga, M. & Vega-Villasante, F. (2026). One hundred weeks of solitude: did the pandemic impact the scientific output of female researchers in three Mexican public research centers? *Agro Productividad*. https://doi.org/10.32854/8ysdm422

Academic Editor: Jorge Cadena Iñiguez
Associate Editor: Dra. Lucero del Mar Ruiz Posadas
Guest Editor: Juan Francisco Aguirre Medina

Received: October 28, 2025.
Accepted: March 14, 2025.
Published on-line: May XX, 2026.

Agro Productividad, 19(4). April. 2026. pp: 105-112.

INTRODUCTION

The COVID-19 pandemic brought with it a series of unprecedented challenges for the global scientific community, affecting both academic production and the work dynamics of researchers. In Mexico, the health contingency led to the closure of higher education institutions and public research centers, forcing researchers to adapt their activities to remote formats, facing limitations in access to laboratories, funding, and academic collaboration (Rivera-Pérez & Mendoza-Becerril, 2021).

According to various publications, one of the sectors most impacted by the pandemic was that of female researchers, who experienced a significant reduction in their scientific output compared to their male colleagues (Cui *et al.*, 2021; Lee *et al.*, 2023). Additionally, it has been documented that female academic faced a greater domestic and caregiving workload, which reduced their available time for research and affected their ability to generate new projects (Infante *et al.*, 2021; Cornejo Hernández, 2022). It has also been mentioned that administrative overload and the need to transform their teaching methodologies into digital environments have exacerbated the difficulties in maintaining their productivity (Cornejo Hernández *et al.*, 2023).

This study analyzes the scientific output of female researchers at three public research centers in Mexico over the last decade. Through the analysis of bibliometric indicators, it seeks to identify whether there was a significant variation in the number of articles published between 2020 and 2024, with an emphasis on the factors that may have influenced this trend, particularly the impact of the COVID-19 pandemic. The findings of this study will provide a better understanding of gender gaps in scientific output and contribute key information for the design of institutional strategies that promote equity in research. This study is based on a literature review that contextualizes the problem, analyzes relevant background information, and establishes the relationship with previous research.

MATERIALS AND METHODS

To assess the impact of the COVID-19 pandemic on the scientific output of female researchers in public research centers in Mexico, a bibliometric analysis was conducted based on data obtained from the Scopus database. A sample of 50 researchers was randomly selected from a total of 103 researchers involved in research in aquaculture, fisheries, aquatic biology, and related disciplines such as oceanography, aquatic ecology, marine biotechnology, or similar fields, registered at three Public Research Centers of the Secretaría de Ciencia, Humanidades, Tecnología e Innovación (SEHCITI):

- Centro de Investigaciones Biológicas del Noroeste (CIBNOR)
- Centro de Investigación en Alimentación y Desarrollo (CIAD)
- Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE)

The names of the researchers were provided directly by their respective institutions at the request of the postdoctoral researcher. The search for scientific output was conducted in the Scopus database, using the following criteria:

- Name of the researcher (as the main criterion).
- Name of the institution (as an affiliation filter).
- Analysis period: Publications between 2014 and 2024.

Scientific articles, book chapters, and reviews were included, regardless of the researcher's position on the list of authors. To avoid attribution errors, each publication was manually verified to ensure that it actually corresponded to the selected researcher.

The number of annual publications by each researcher was recorded in an Excel spreadsheet. Subsequently, timeline graphs were generated to analyze the evolution of scientific production at the following levels: i) By research center, at, where a line graph was created for each of the three centers, and ii) a consolidated analysis, in which the data from the three centers were integrated into a single general timeline graph.

This analysis made it possible to identify trends in the scientific output of female researchers, with a special emphasis on possible variations during the pandemic (2020-2024).

RESULTS AND DISCUSSION

The three public research centers show variable scientific output over the ten-year period.

Analysis of the scientific output of researchers at the three public research centers (CIBNOR, CICESE, and CIAD) between 2014 and 2024 shows a general upward trend, although with notable fluctuations throughout the period analyzed (Figure 4). Although the COVID-19 pandemic caused a drop in productivity in 2020, the recovery was not uniform across the different centers, suggesting that institutional factors and changes in funding policies may have influenced publication dynamics.

Production at CIBNOR follows a pattern of moderate growth, with fluctuations but an overall upward trend. In 2020, production registered 38 publications, while in 2022 there was a peak of 47 publications. In 2024, production declined slightly again to 34 publications.

At CIBNOR, scientific production showed significant variations in the period 2014-2018, with an increase in 2016 followed by a decrease in 2017 (Figure 1). From 2019 onwards, sustained growth is observed, reaching its peak in 2022. This increase could be related to the publication of works delayed by the pandemic or to an institutional reorganization that facilitated the productivity of female researchers. However, in 2023 there is a sharp drop, which could be due to changes in the criteria of the National System

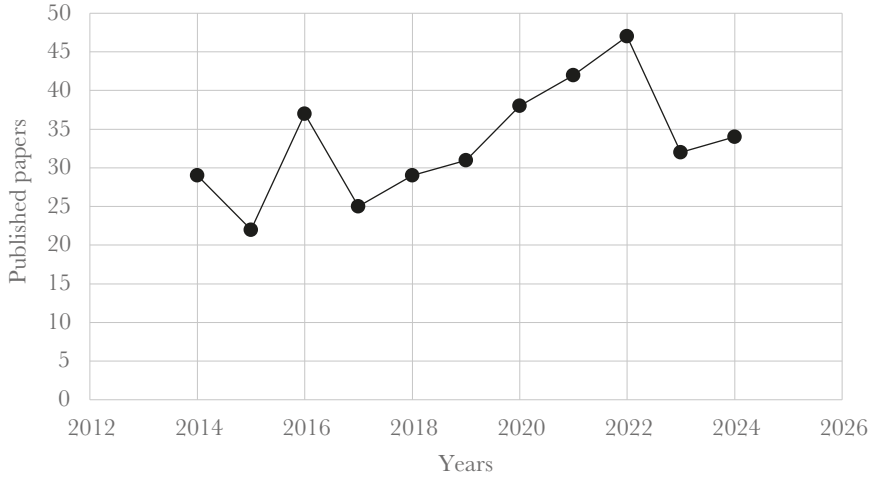

Figure 1. Timeline of scientific publications by female researchers at CIBNOR. Own elaboration based on data obtained from SCOPUS.

of Researchers (SNI) and the implementation of the National Postgraduate System (SNP), which may have affected the prioritization of academic activities. In 2024 there is a slight rebound, although without reaching the levels prior to the drop.

CICESE's productivity shows a sharp decline in 2020 (20 publications), making it the center with the greatest negative impact during the pandemic. The recovery is notable in the following years, reaching 41 publications in 2021 and 35 in 2022. In 2024, production stands at 29 publications, indicating that the recovery has not been sustained at this center. Production at CICESE shows a pattern of growth interrupted by fluctuations in different periods (Figure 2). Between 2014 and 2015, productivity was low, with fewer than 10 publications. From 2016 onwards, there was an increase to a peak of around 30 publications, followed by relative stability until 2018. However, in 2020, productivity declined significantly, coinciding with the global health crisis. Unlike CIBNOR, CICESE shows a significant rebound in 2021, exceeding 40 publications, suggesting that some research postponed during the pandemic may have been completed and published during this period. Nevertheless, from 2022 onwards, production begins to decline progressively until 2024, which could indicate a long-term impact of the health crisis or the reallocation of efforts to other academic activities.

At CIAD, the impact of the pandemic in 2020 does not appear to be as severe as at the other centers, as it maintains 40 publications, similar to 2019. However, in 2022, production falls to 33 publications, showing a later recovery. By 2024, CIAD has the highest number of publications among the three centers, with 53 publications.

In the case of CIAD, scientific production shows a more stable trend compared to CIBNOR and CICESE, although it also presents significant fluctuations (Figure 3). Between 2014 and 2016, productivity remained at around 30 publications per year, with no significant variations. In 2017, however, there was a sharp drop, reducing production to around 20 publications. Subsequently, between 2018 and 2020, production experienced sustained growth until stabilizing at around 40 publications. Unlike the other centers, in 2020 the pandemic does not seem to have caused an immediate decline in productivity, suggesting that researchers at this center may have found more effective strategies to continue

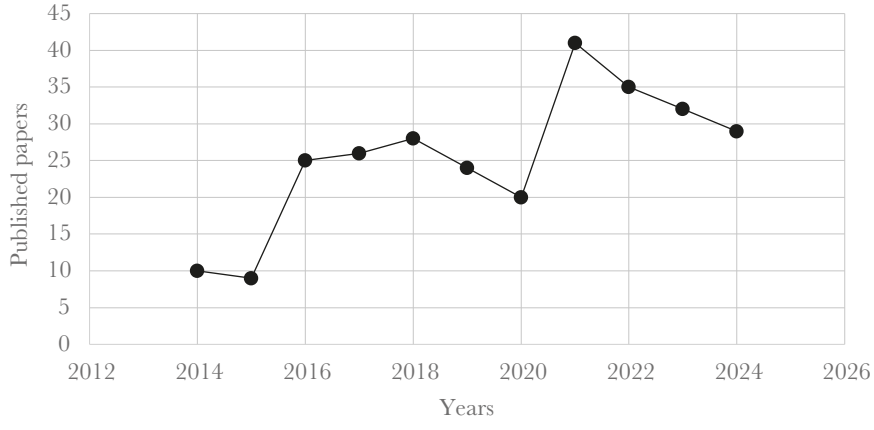

Figure 2. Timeline of scientific publications by female researchers at CICESE. Own elaboration based on data obtained from SCOPUS.

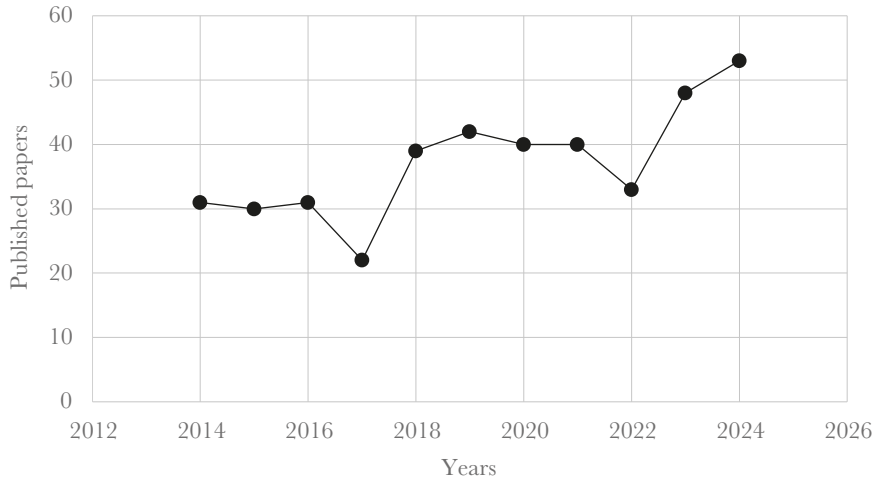

Figure 3. Timeline of scientific publications by female researchers at CIAD. Own elaboration based on data obtained from SCOPUS.

their projects under lockdown conditions. However, in 2022, there is a sudden new drop, which could be associated with the implementation of new scientific policies or difficulties in the allocation of funding. In 2023 and 2024, productivity recovers significantly, reaching the highest level of the period analyzed, with more than 50 publications in the last year.

In general terms, the graph of totals (Figure 4) shows a pattern of growth in the scientific output of female researchers in the three centers combined, although with moments of crisis. There was a decline between 2014 and 2016, followed by sustained growth until 2020. With the pandemic, production temporarily declined, but from 2021 onwards there has been a gradual recovery, with an upturn of 116 publications by 2024. However, the decline in 2023 suggests that the effects of the health crisis and changes in scientific policies are still impacting academic productivity.

These results show that, although female researcher's scientific output has shown a positive long-term trend, the fluctuations observed may be linked to factors such as the

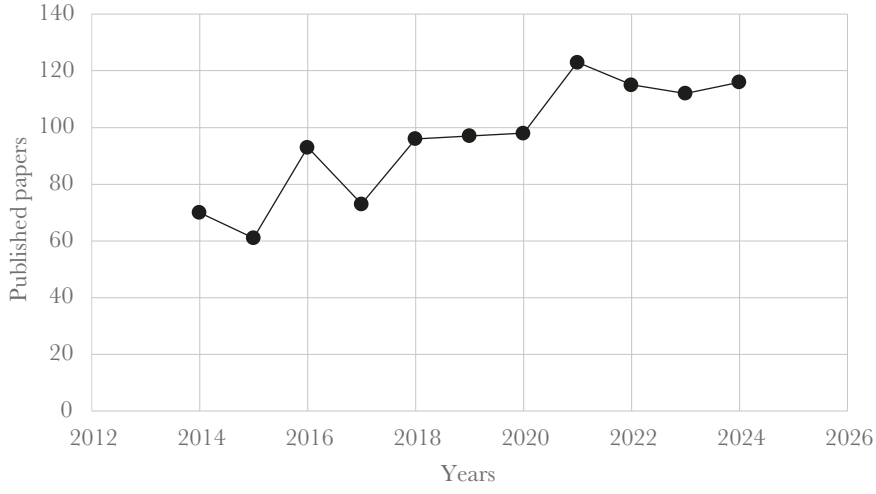

Figure 4. Consolidated timeline of scientific publications by female researchers from the three public research centers. Own elaboration based on data obtained from SCOPUS.

pandemic, the availability of funding, and changes in productivity assessment mechanisms in Mexico. The heterogeneity in post-pandemic recovery among the three centers suggests that institutional conditions played a key role in female researchers' ability to resume their scientific output.

The results show a general trend of growth in the scientific output of female researchers during the period 2014-2024. However, significant fluctuations are also observed, particularly in 2017, 2020, and 2023, which may be associated with structural, administrative, and social factors that have impacted the publication dynamics of female scientists in Mexico.

Overall, the COVID-19 pandemic (2020-2022) did not have an immediate negative impact on the total scientific output of female researchers at these centers. In fact, CIBNOR and CICESE saw an increase in productivity in the following years. This phenomenon can be explained by several hypotheses.

The drop in productivity in 2020 may have been a consequence of the interruption of ongoing research and the closure of laboratories. However, in subsequent years, many researchers managed to complete their projects and submit them for publication, generating a "rebound effect" in 2021-2022 (Squazzoni *et al.*, 2021). This phenomenon has already been documented in other studies, which indicate that the pandemic did not necessarily reduce scientific output permanently, but rather altered the dynamics of publication, with a temporary shift in articles (Myers *et al.*, 2020).

Digital infrastructure and access to collaborative networks may have been key factors in the recovery of scientific output. If CIBNOR and CICESE managed to implement effective remote working strategies and facilitated communication among researchers, their productivity may have remained steady or even increased compared to other centers. In contrast, CIAD experienced a decline in 2022, which could indicate that its researchers faced greater barriers to regaining their post-pandemic publication pace.

Although it has been reported that many researchers devoted more time to teaching and administrative tasks during the pandemic, it is possible that at CIBNOR and CICESE some scientists managed to reorganize their time and prioritize writing articles. It is also possible that certain research groups took advantage of this period to strengthen theoretical production and literature review, which may have facilitated the increase in publications at these centers.

One of the most relevant findings is the decline in scientific production in 2020, followed by a rebound in 2021-2022 and a further decline in 2023. This pattern has been reported in other studies on the impact of the pandemic on science, which highlight that female academics faced greater difficulties in maintaining their productivity due to domestic and care workloads, adaptation to online teaching, and lack of access to laboratories and scientific collaboration networks (Viglione, 2020; Squazzoni *et al.*, 2021). The gender gap in post-pandemic recovery has also been documented. Studies have shown that while male scientists were able to recover their publication levels more quickly, many women experienced a prolonged decline in their academic output due to extra-professional responsibilities that limited their research time (Cui *et al.*, 2021; King & Frederickson, 2021). This would partly explain the decline observed in 2023, when the

cumulative effects of work overload became more evident in the productivity of female researchers.

The decline in scientific output in 2017 and 2023 could be linked to changes in science funding and evaluation policies in Mexico. In 2017, the reform of the National System of Researchers (SNI) and adjustments to funding mechanisms may have generated uncertainty and a restructuring of research priorities, which affected the publication of scientific articles.

More recently, in 2022-2023, the implementation of the National Postgraduate System (SNP) to replace the PNPC, as well as changes in the SNI's evaluation criteria, may have influenced the prioritization of academic activities other than the publication of articles. Researchers may have focused on activities that were given greater weight in the new systems, such as outreach, dissemination, or teaching, pushing the production of scientific publications into the background.

The analysis by center reveals that CIAD showed the fastest recovery in 2023 and 2024, while CICESE and CIBNOR have experienced more pronounced declines in their recent publications. This suggests that institutional conditions and adaptation strategies have differed across centers.

Previous studies have pointed out that job flexibility and the availability of institutional support can make a difference in the ability of female scientists to resume their productivity after crises or structural changes (Myers *et al.*, 2020). CIAD may have implemented more effective strategies to support female researchers, facilitating their recovery, while at other centers, post-pandemic conditions may have made it difficult to return to previous publication levels.

The literature has pointed out that women scientists face additional barriers in academia, including heavier teaching and administrative loads, smaller international collaboration networks, and challenges in accessing funding and leadership in projects (Huang *et al.*, 2020; Malisch *et al.*, 2020). These inequalities may have influenced the variability observed in the scientific output of women researchers at the centers analyzed.

In addition, recent social movements, such as #MeTooAcadémicosMX (2019) and feminist strikes at Mexican universities (2020-2021), have highlighted structural problems of gender inequality in academia. It is possible that the increased attention to these issues has had an impact on the workload of female researchers, who have been actively involved in implementing gender equality policies at their institutions, taking time away from their research.

CONCLUSIONS

The results reflect the complex interaction between external events, scientific policies, and gender inequalities in the scientific output of female researchers in Mexico. Although the overall trend has been one of growth, the fluctuations observed in 2017, 2020, and 2023 suggest that female scientists have faced significant challenges at different points during the period analyzed.

The impact of the pandemic remains evident in the uneven recovery of productivity, with a late decline in 2023 reflecting the persistence of the cumulative effects of work

overload and changes in the science and technology system. Differences between research centers highlight the importance of institutional conditions and specific support for women researchers.

To achieve a sustained recovery and close the gender gap in science, it is essential to implement policies that facilitate the reconciliation of research with other academic and personal responsibilities, as well as to ensure equitable conditions in the distribution of funding and the evaluation of women's scientific output in academia.

ACKNOWLEDGMENTS

We would like to thank the Secretaría de Ciencia, Humanidades, Tecnología e Innovación (SECIHTI) for the National Postdoctoral Fellowship for Mexico (renewal 2024) awarded to the first author (OCC). We would also like to thank the University of Guadalajara for its support in carrying out this study.

REFERENCES

Cornejo-Hernández, A. (2022). Una mirada en torno a la pandemia por Covid-19 desde la experiencia de algunas académicas en México. Ichan Tecolotl revista del CIESAS no. 358. Retrieved from https://ichan.ciesas.edu.mx/una-mirada-en-torno-a-la-pandemia-por-covid-19-desde-la-experiencia-de-algunas-academicas-en-mexico/

Cornejo Hernández, A., Pérez Manríquez, L.M., & Suárez Olvera, F. (2023). Feminización y precarización: rasgos de la experiencia de las académicas en México durante la pandemia por COVID-19. *LiminaR, 21*(2), e101.https://doi.org/10.29043/liminar.v21i2.1001.

Cui, R., Ding, H., & Zhu, F. (2021). Gender inequality in research productivity during the COVID-19 pandemic. *Manufacturing & Service Operations Management, 24*(2), 707-726. https://doi.org/10.1287/msom.2021.0991

Huang, J., Gates, A.J., Sinatra, R., & Barabási, A.L. (2020). Historical comparison of gender inequality in scientific careers across countries and disciplines. *Proceedings of the National Academy of Sciences, 117*(9), 4609-4616. https://doi.org/10.1073/pnas.1914221117

Infante Castañeda, C., Peláez Ballestas, I., & Giraldo Rodríguez, L. (2021). Covid-19 y género: efectos diferenciales de la pandemia en universitarios. *Revista mexicana de sociología, 83*(spe), 169-196. .https://doi.org/10.22201/iis.01882503p.2021.0.60072.

King, M.M., & Frederickson, M.E. (2021). The pandemic penalty: The gendered effects of COVID-19 on scientific productivity. *Socius*, 7. https://doi.org/10.1177/23780231211006977

Lee, K.G., Mennerat, A., Lukas, D., Dugdale, H.L., & Culina, A. (2023). The effect of the COVID-19 pandemic on the gender gap in research productivity within academia. *eLife*, 12, e85427. https://doi.org/10.7554 /eLife.85427

Malisch, J.L., Harris, B.N., Sherrer, S.M., Lewis, K.A., Shepherd, S.L., McCarthy, P.C., Spott, J.L., Karam, E.P., Moustaid-Moussa, J.M., McCrory C., Latha-Ramalingam, A. E., Talley, J. E. Cañas-Carrell, Ardon-Dryer, K.,. Weiser, D.A., Bernal, X.E & Deitloff, J. (2020). In the wake of COVID-19, academia needs new solutions to ensure gender equity. *Proceedings of the National Academy of Sciences, 117*(27), 15378-15381. https://doi.org/10.1073/pnas.2010636117

Myers, K.R., Tham, W.Y., Yin, Y., Cohodes, N., Thursby, J.G. Marie C. Thursby, Schiffer, P., Walsh, J.T., Lakhani K.R. & Dashun Wang. (2020). Unequal effects of the COVID-19 pandemic on scientists. Nature Human Behaviour, 4(9):880-883. doi: 10.1038/s41562-020-0921-y. PMID: 32669671

Petersen, A.M. (2022). Persistent gender disparities in citations of high-impact papers. *Nature Communications*, 13, 4214.

Rivera-Pérez, C., & Mendoza-Becerril, M.A. (2021). Efecto de la pandemia COVID-19 en el quehacer científico: docencia e investigación. *Recursos Naturales y Sociedad, 7*(2), 35-45. https://doi.org/10.18846/renaysoc.2021.07.07.02.0003

Squazzoni, F., Bravo, G., Grimaldo, F., García-Costa, D., Farjam, M., & Mehmani, B. (2021). Gender gap in journal submissions and peer review during the first wave of the COVID-19 pandemic. A study on 2329 Elsevier journals. *PLoS ONE 16*(10): e0257919. https://doi.org/10.1371/journal.pone.0257919

Viglione, G. (2020). Are women publishing less during the pandemic? Here's what the data say. *Nature, 581*(7809), 365-366. doi: 10.1038/d41586-020-01294-9. PMID: 32433639.