

## Original Research Article

# Exploring gender disparities among first authors in Alzheimer's disease publications: an analysis of potential underrepresentation of women

Myo Thant Kyaw<sup>1\*</sup>, Saw Paul Wai Htoo<sup>2</sup>, Megha Ganatra<sup>3</sup>, Navya Pillikunte Doddareddy<sup>4</sup>, Ravi Kumar Ray<sup>5</sup>, David Joshua<sup>6</sup>

<sup>1</sup>University of Medicine, Mandalay, Myanmar

<sup>2</sup>University of Medicine, Yangon, Myanmar

<sup>3</sup>St George's University, Grenada, West Indies

<sup>4</sup>Bangalore Medical College and Research Institute, Bangalore, Karnataka, India

<sup>5</sup>Nepal Medical College, Kathmandu, Nepal

<sup>6</sup>Government Medical College, Chennai, Tamil Nadu, India

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### \*Correspondence:

Dr. Myo Thant Kyaw,

E-mail: myotkyaw1@gmail.com

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## ABSTRACT

**Background:** Gender imbalance in scientific research remains a persistent issue, with women being underrepresented in authorship positions, especially as first authors. This study aims to investigate gender disparities in Alzheimer's disease research, focusing on the representation of female first authors.

**Methods:** An epidemiological study was conducted using data extracted from the PubMed and National Institute of Health databases, spanning 20 years (2003-2022) and focusing on Alzheimer's disease articles. The gender of the initial authors was determined using the Namsor website.

**Results:** Of the 142 publications analysed, 141 had specified initial authors, with 77 females and 64 males. The annual number of first authors, both male and female, showed variations throughout the study period. India had the highest gender ratio (3), followed by China (2.67) and Mexico (2). Fisher's Exact Test revealed a significant association between the first author's gender and their country of origin.

**Conclusions:** The correlation between gender and country underscores the importance of addressing cultural and institutional factors in promoting inclusivity and diversity.

**Keywords:** Alzheimer's disease, Female authors, First authors, Gender disparity, Gender ratio

## INTRODUCTION

Gender imbalance remains a persistent issue in a variety of domains, including the realm of scientific research.<sup>1-4</sup> Generally, gender differences in scientific research have received minimal attention when considering the growing significance women hold in academia and research.<sup>5,6</sup> Numerous studies have shown that women have a lesser share of authorship positions overall and are less likely than men to be first authors in various scientific discussions.<sup>7,8</sup> Academic publications are one of the

primary means of demonstrating scientific knowledge, and are known to influence career paths of women in science and academia.

This study was conducted to determine the gender disparities in Alzheimer's disease research, with a particular focus on the representation of female first authors. The aim was to understand the ratio of first authors in publications related to Alzheimer's disease and examine the potential underrepresentation of women.

To achieve these objectives, an epidemiological study was conducted. Data was gathered from the PubMed and National Institute of Health databases. This data collection spanned 20 years, focusing on articles related to Alzheimer’s disease.

In recent years, efforts have been made to help alleviate gender gaps in science and academia, including challenging social norms and changing institution policies. Despite these efforts, gender imbalance is still seen today, and this study was conducted to test the hypothesis that there would be evidence of underrepresentation of women in the field of Alzheimer’s disease research.

In the realm of research, gender inequality is a well-known scenario. The authors aimed to look at the disparities in Alzheimer’s disease research. The submitted research on the topic of interest was observed and discovered the gender of the first author. It is hypothesised that women are underrepresented in the field of Alzheimer’s research.

**METHODS**

**Study setting**

An epidemiological study was conducted virtually from July 2023 to August 2023 to understand the gender ratio of the initial authors who have published articles on Alzheimer’s disease. As this was a virtual bibliometric study conducted entirely using publicly available online databases, no institutional or hospital setting was involved, no physical study site is applicable, and ethics committee approval was not required.<sup>9,10</sup>

**Data source**

For this study, data was extracted from PUBMED, National Institute of Health (.gov) database, on July 14<sup>th</sup>, 2023. Information collected from this includes, initial author’s name, gender of the author and country of origin of the same author.

**Data selection**

From the database of PubMed, articles of Alzheimer’s disease, from the year 2003- 2023 was reviewed and total of 142 publications in total met the requirements for inclusion. One of the publications had no name of the initial author, so total of 141 publications were used in study. Using Namsor website, the gender of the initial author was calculated using name and country code.

The gender frequencies and gender ratio of the top journals was calculated and appropriate tables are made to display the top journals with favourable gender ratio, the countries with high gender ratios and journals with high gender ratios, to which the criteria included was to have at least 4 publications.

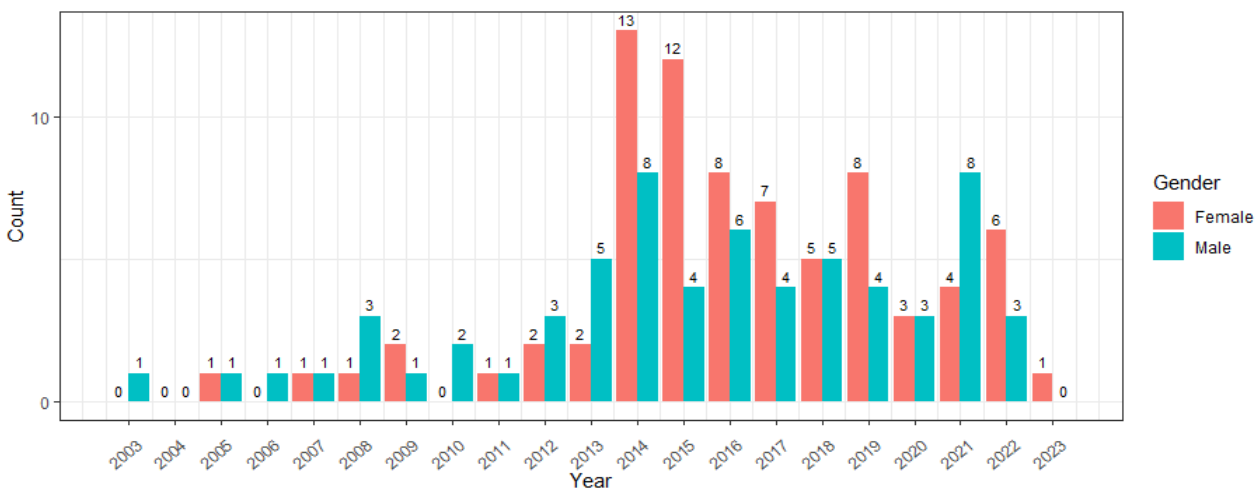
**Statistical analysis**

All data was included in MS Excel, and appropriate models of percentages and proportions were used to express the data. The statistical model used is ARIMA model. The modelling data is taken from 2003-2022. The forecasting is done from 2003-2027.

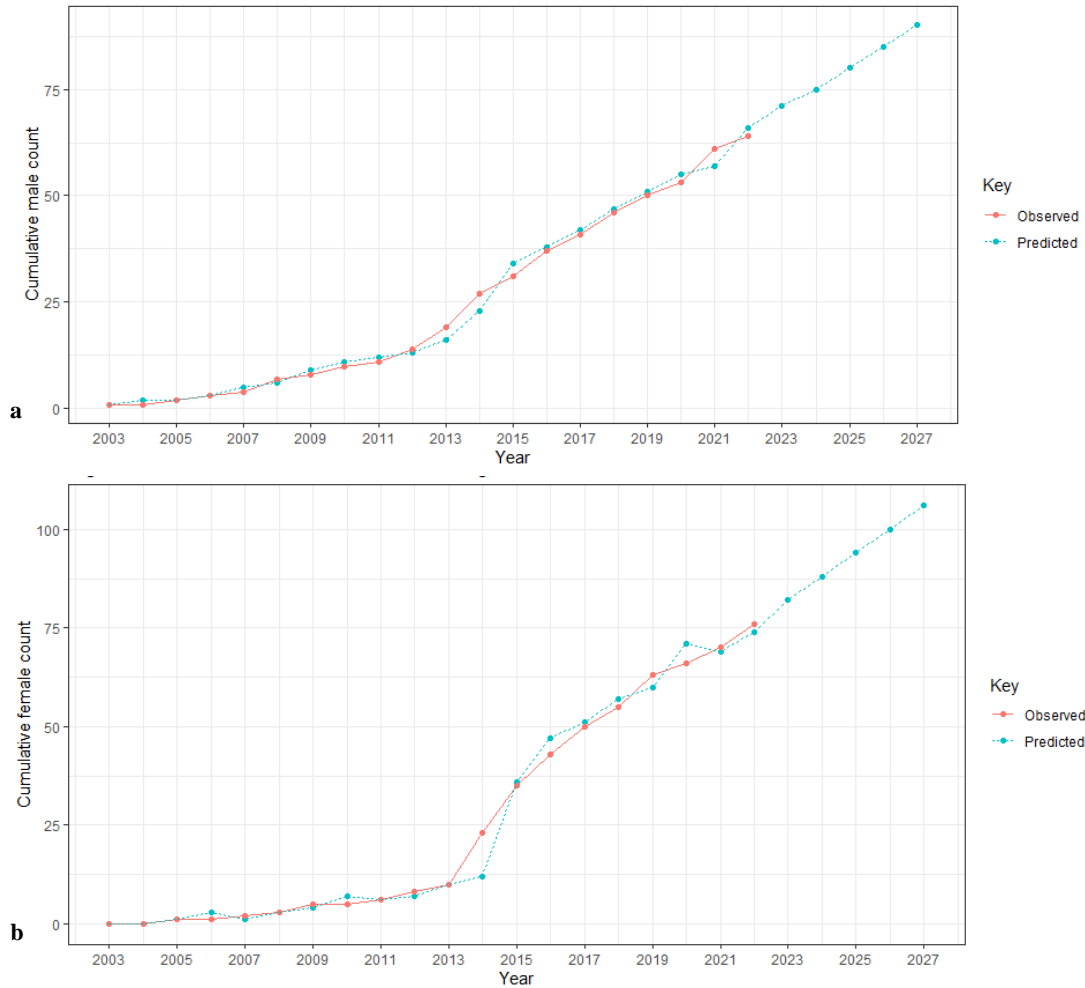
**RESULTS**

Total 142 publications in total met the requirements for inclusion. Since the initial author’s name is not listed in one of the publications, only 141 of these were used in the study. The initial authors’ genders, according to gender API, are 77 female and 64 males.

The overall annual number of first authors, both male and female, is shown in Figure 1. 2014 was the year with the most female first authors. In 2014 and 2021, there were the most male first authors.

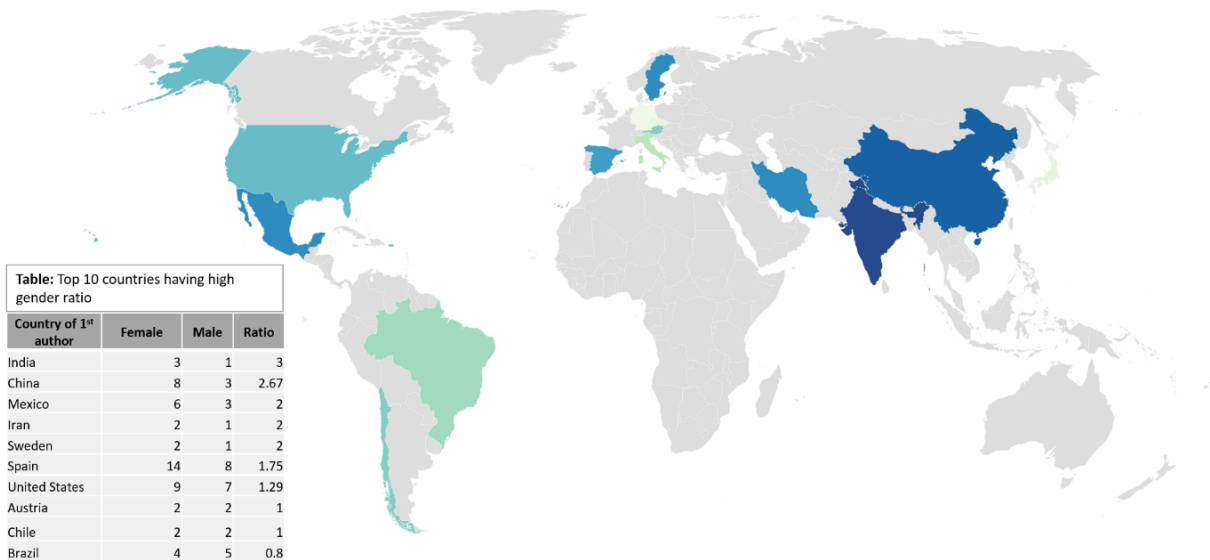


**Figure 1: Total number of male and female first authors based on year.**



**Figure 2 (a and b): Observed publication trends among cumulative male count in first authors from 2003 to 2022 and prediction of trends for the next 5 years.**

**Figure 3: Gender trends in publications (2003-2023) based on country**



**Figure 3: The map illustrates the gender ratio of female to male first authors across countries contributing at least 4 publications on Alzheimer's disease (2003-2023).**

The observed publishing trends for male and female first authors from 2003 through 2023 are depicted in Figure 2. Over the subsequent five years, the trend is expected to intensify.

India has a gender ratio of 3 that is the highest among the various nations. China, which ranks second behind India in terms of gender ratio with 2.67, is followed by Sweden, Mexico, Iran, and Mexico, each with a ratio of 2 (Figure 3).

Table 1 shows the top journals having favourable gender ratios. Table 2 shows the top countries having high gender ratio.

**Table 1: Top journals having favourable gender ratio.**

Journal Book	Female	Male	Ratio
Curr Alzheimer Res	1	2	0.5
Curr Neuropharmacol	1	2	0.5
Arq Neuropsiquiatr	1	1	1
Ceska Slov Farm	1	1	1
Comput Methods Programs Biomed	1	1	1
Eur J Pharmacol	2	2	1
Exp Gerontol	1	1	1
J Ethnopharmacol	1	1	1
Med Hypotheses	1	1	1
Psychiatry Res	3	2	1.5

**Table 2: Top countries having high gender ratio (at least 4 publications).**

Country of 1 <sup>st</sup> author	Female	Male	Ratio
India	3	1	3
China	8	3	2.67
Mexico	6	3	2
Spain	14	8	1.75
United States	9	7	1.29
Austria	2	2	1
Chile	2	2	1
Brazil	4	5	0.8
Italy	3	5	0.6
Czech Republic	1	4	0.25

**Table 3: Top journal having high gender ratio.**

Journal Book	Female	Male	Ratio
Plos One	5	2	2.5
Int J Mol Sci	2	1	2
Neuropsychologia	2	1	2
Sci Rep	2	1	2
Psychiatry Res	3	2	1.5
Eur J Pharmacol	2	2	1
Arq Neuropsiquiatr	1	1	1
Ceska Slov Farm	1	1	1
Comput Methods Programs Biomed	1	1	1
Exp Gerontol	1	1	1

Table 3 shows the top journals having high gender ratio. For the variables related to gender and country, we used Fisher's Extract Test. According to our research, there is a substantial correlation between gender and country (p value <0.05).

**DISCUSSION**

The issue of gender disparity in scientific research has been a topic of significant interest and concern. Our study delves into the representation of genders among first authors in Alzheimer's research. These findings offer a comprehensive understanding of gender dynamics within this specific field, providing a backdrop against which broader trends in biomedical research can be compared.

In this study, the authors observed a near-equal representation of male and female first authors in Alzheimer's research, with 77 females and 64 males. This balance is commendable, especially when compared to the wider context of biomedical research. However, a single entry did not specify gender, emphasizing the importance of comprehensive reporting in future studies.

Another study by Menzel et al spanning from January 1, 2008, to August 24, 2017, analysed 37,961 original research articles containing the keyword "Alzheimer."<sup>11</sup> This study found that women held 50.2% of the first authorships. Such data closely aligns with our findings, suggesting a consistent trend of near-equal gender representation in Alzheimer's research over the years.

In contrast, a 2021 study by Muric et al highlighted a decline in the proportion of female first authors during the pandemic across various biomedical disciplines.<sup>12</sup> This decline was particularly pronounced in COVID-19 research papers, where there was a drop of 28%. Such a disparity, when compared to our findings in Alzheimer's research, suggests that while Alzheimer's research may be progressing towards gender balance, other areas, especially those at the pandemic's forefront, might still exhibit significant gender disparities.

Moreover, data from another study by Mehran et al on Randomized Controlled Trials (RCTs) in cardiology over the past decade showed fluctuating proportions of female first authors.<sup>13</sup> While our study identified a near-equal representation of male and female first authors in Alzheimer's research, the RCT data consistently showed an underrepresentation of female first authors, with percentages ranging from 22% to 35% over the years. This disparity in cardiology research accentuates the imperative to address gender imbalances across all scientific disciplines.

The trend analysis in our study, which utilized the ARIMA model, predicts the publication trends for the next five years. Such forecasting transcends mere statistical exercise, serving as a roadmap for policymakers and stakeholders. If predicted trends hint at potential

disparities, it beckons the scientific community to adopt proactive measures, ensuring sustained gender balance.<sup>14,15</sup>

A particularly intriguing finding from our study was the correlation between the first author's gender and their country of origin. The Fisher's Exact Test produced a P-value of 0.03248, indicating a significant association between gender and country. Countries like India, China, and Mexico showcased a higher female-to-male ratio, suggesting a dominant female representation in Alzheimer's research from these regions. Conversely, countries like Brazil and Italy leaned towards male dominance. Such disparities might stem from various factors, including cultural norms, educational opportunities, and institutional policies, emphasizing the necessity for a global perspective when addressing gender disparities. It is crucial to recognize that solutions might require tailoring to specific cultural or national contexts.<sup>16,17</sup>

In conclusion, this study furnishes a detailed analysis of gender representation in Alzheimer's research. The findings spotlight both the advancements made and the impending challenges. By comparing these findings with those from other studies, it becomes evident that while significant progress has been achieved in realizing gender balance in Alzheimer's research, broader biomedical fields still have milestones to cover. As the scientific community continues its journey towards inclusivity and diversity, studies like ours serve as both a mirror and a compass, reflecting the current state and guiding the way forward.

This study has few limitations. The authors relied on the PubMed database for data extraction, potentially missing some Alzheimer's-related publications. The method of gender identification, based on first author names, might not always be accurate due to cultural variations in naming conventions. One entry in this dataset did not specify gender, highlighting occasional data gaps. The trend analysis, based on past and present data, might not account for unforeseen future changes in the research landscape.

While the findings of this study were compared with other studies, it's essential to note that each study has its methodologies, scopes, and limitations. Direct comparisons should be made with caution.

## CONCLUSION

In this study, it was found that the number of women publishing Alzheimer's research is increasing, which is encouraging. However, disparities persist in the other sector of biomedical research. As research should always be inclusive, there is still opportunity for development. The considerable relationship between gender and country means that efforts should be made to provide equitable opportunities across nations. This research is simply a mirror of societal truth.

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