

Dementia and its Relations Between the Late 20th and 21st Century

Gian Marco Di Feo

Laurentian University, Department of Psychology

Michael Emond

Laurentian University, Department of Psychology

Kassra Ghassemkhani

Laurentian University, Department of Psychology

ABSTRACT

This study was conducted to examine changes in the beliefs and contents of articles on dementia from the 20th century. Factors analyzed included the form of dementia, pharmaceutical drugs, source country and income of the first author, diagnostics, and the year of publication. All articles (N=202) analyzed were published between January 1st, 1984, and December 31st, 2022. Inter-rater reliability was assessed and there was an 89.4 percent agreement amongst raters. All articles were analyzed through both PubMed and PsycInfo. Our results proved that a significant number of articles discussed Alzheimer's disease. Scientific perspectives on the cause of dementia have not changed significantly between the 20th and 21st century. Additionally, there were no significant differences between high-, middle- and low-income countries discussing pharmaceutical drugs in literature.

Keywords: Dementia, Alzheimer's disease, pharmaceutical drugs, diagnostics, comorbidities.

INTRODUCTION

Dementia rates in North America have increased over time and are on the rise (Boscart, et al, 2019). The mean prevalence rates of dementia in people aged 65 years and over was 2.2 percent in Africa, 8.9 percent in Europe, 1.3 percent in India and 14.9 percent in Spain (Lopes, et al, 2007). Age directly influences the rates of dementia with the most prevalent group being those between 90 and 94 years of age (Lopes, et al, 2007).

This study examined four separate forms of dementia across published scientific articles over time. The forms of dementia researched in this study include Alzheimer's disease, Lewy body dementia, vascular dementia, and frontotemporal dementia. As there is no cure for dementia, we in this study chose to gain insight on how treatments have changed over time and their relationship to various subtypes of the disease. Also, since there is no cure for dementia, research on older patients is scarce for medical practitioners in Western countries (Clarnette & Patterson, 1994). As life expectancy increases, the prevalence of people being diagnosed with dementia is anticipated to increase significantly (Hampel, et al, 2018).

In addition, we decided to explore the relationship of comorbid diseases of dementia and how this has changed in published research over time. Comorbidities of dementia are a critical aspect to psychiatric research and evaluation as symptoms can add difficulties to the process of diagnosing and treating the disease (Lee & Weintraub, 2012). Furthermore, psychological diseases can be diagnosed alongside any form of dementia (Sobczak, et al., 2021). These comorbidities can make a dementia diagnosis difficult to obtain.

We examined the relationship between pharmaceutical drugs and dementia over time. Pharmaceutical interventions are a main course of treatment for dementia (Tanaka, et al, 2020). The prescription of acetylcholine receptor inhibitors such as donepezil, galantamine N-Mythel-D-aspartate receptor (NMDA) have increased in prevalence (Tanaka, et al, 2020). There are several reasons why we chose to examine the topic of dementia. These reasons include that, treatments have changed remarkably, there is no cure for the disease, the prevalence of dementia has and continues to increase exponentially, and variations in research between geographical regions are prevalent.

RESEARCH QUESTIONS AND/OR HYPOTHESIS

First Hypothesis

We hypothesized that Alzheimer's disease would be the most common form of progressive dementia to have been discussed in the articles analyzed. The main reason for this hypothesis is that Alzheimer's disease is the most diagnosed form of dementia globally (Karantzoulis & Galvin, 2011). Furthermore, the first set of clinical criteria was created in 1984 which is later than other forms of dementia (Karantzoulis & Galvin, 2011). Alzheimer's disease has increased significantly between 1990 and 2011 in all countries regardless of income (Chan, et al, 2013). Alzheimer's disease is also the most studied form of dementia amongst research since it affects a significant level of people (Karantzoulis & Galvin, 2011).

Second Hypothesis

A further hypothesis of this study was that most articles assessed would be published from high income countries. It was hypothesized that most articles analyzed would be published from the United States of America, Canada, and the United Kingdom. We hypothesized this as most published articles in neuropsychology originate from North America and the United Kingdom (Di Feo & O'Connell, 2022). For this study, we defined each region by its level of income. The income of country for each article was marked by the location of its institution. For example, for an article published at Laurentian University, the country would be classified as Canada and therefore would be marked as a high-income country.

Third Hypothesis

Another hypothesis was that there would be a significant number of articles discussing pharmaceutical drugs as treatment for dementia in the twenty first century. In scientific literature there has been a significant increase in the mentioning of pharmaceutical drugs (Di Feo & O'Connell, 2022; Di Feo & Whissell, 2020). Also, the level of drugs prescribed for dementia as well as the development of pharmaceutical drugs has increased over time across all countries regardless of income (Zagorska, et al, 2023). Despite this, drug intervention is a more common treatment in high income countries (Zagorska, et al, 2023). Part of this hypothesis was that treatments would differ between high income countries and middle- and low-income countries.

Particularly, articles published from high income countries would be significantly more likely to discuss pharmaceutical drugs as a treatment option for dementia.

Research conducted in dementia has incorporated medical technologies such as the MRI, fMRI, CT, and EEG as well as pharmaceutical interventions predominantly since the 1990s (Smith-Bindman, et al, 2019). Therefore, we hypothesized that the use of brain scans would increase significantly in the twenty first century. Similarly, we hypothesized that brain scans as a diagnostic method would be more frequently studied in high income countries.

Fourth Hypothesis

It was hypothesized that comorbid diseases discussed in published articles relating to dementia would increase significantly within the twenty first century. The reason for this hypothesis is that the prevalence of developing dementia with a comorbid disease has both increased over time and continues to rise (Koyama, et al, 2013). This increase has occurred across all genders, ethnicities, and demographic regions (Koyama, et al, 2013). The reason for this increase is that many comorbid disorders of dementia such as supranuclear palsy, depression, and Huntington's disease have also become more prevalent over time (Poblader-Plou, et al, 2014). The commonality of comorbid diseases can make a diagnosis of dementia additionally challenging due to the overlapping symptoms between diseases.

Fifth Hypothesis

The final hypothesis in this study is that the articles analyzed in the twenty first century would discuss both environmental and biological factors as the cause of dementia. The etiology of dementia is widely believed to result from a combination of genetic and environmental factors (Gatz, et al, 2006). It was also predicted that there would be a significant number of articles from the 20th century (1984 to 2000) speculating only biological factors as the cause of dementia compared to articles in the 21st century. This was predicted as there has been a resurgence in testing for environmental cues involved with the development of dementia (Gatz, et al, 2006). Furthermore, projects supported by the U.S. National Institutes of Health has increasingly focused on the use of human based models and methods investigating various factors such as stem cells, air pollution, inheritance, and neuroimaging since the early 2000s (Pistollato, et al, 2016). Environmental factors in this study include prenatal factors, exposure to minerals, air pollution, water quality, nuclear facilities, alcohol and substance abuse, contamination, and trace elements. Biological factors in this study include genetic mutations, epigenetics, cerebral infarctions, stroke, genetic influences, and gender.

METHODOLOGY

Articles

In this study we used two databases to access articles on the topic of dementia. Specifically, PubMed and PsycArticles were accessed to analyze all articles (N=202). Both search engines were accessed through the Laurentian University library database. All articles selected had to have either dementia or Alzheimer's disease, Lewy body dementia, vascular dementia or frontotemporal dementia mentioned in the title and/or the abstract. Key search terms on both PubMed and PsycArticles included "dementia and comorbidities" as well as "dementia and diagnosis" and "dementia and environmental factors". Another search with these terms was conducted using articles published solely between January 1st, 1984, and December 31st, 2000.

Systematic random sampling was conducted as every tenth article from each search was selected for analysis.

The years of articles ranged between January 1st, 1984, to December 31st, 2022. We examined research articles beginning in 1984 since the clinical criteria for a diagnosis of Alzheimer's disease was established during this year. Also, inter-rater reliability was assessed through a random sampling of 30 articles (N=30) by a second rater.

The articles were assessed for the factors examined in this study. These factors include the region of the published article (high, middle, or low income), comorbid diseases discussed in the article, country of the first author, the form of dementia discussed in the article, the year that the article was published, causes of dementia, as well as the diagnostics and treatments of dementia. The inter-rater reliability was assessed and there was an 89.4% agreement between both raters.

Statistics

Scores of the factors in this study were computed in Excel. The countries income was coded numerically. If the source country could not be found, it was given a score of 0, while a high-income country was given a score of 1, and a low- or middle-income country was given a score of 2. We decided on the region of income based off the world bank which is a website that groups countries by their income. The country of the first author was used as the publishing country. Drug therapy was coded as either absent (0) or cited (1). Additionally, a separate column on Excel was coded for Alzheimer's disease with either an absent (0) or cited (1). This method on Excel was also used for the other three forms of dementia (frontotemporal dementia, Lewy body dementia and vascular dementia).

Descriptive statistics such as the frequency, were conducted for the country of the published article. The articles were divided into specific year groups. The year groups were broken down into the following categories: 1984 to 1993, 1994 to 2003, 2004 to 2013, 2014 to 2022. The year groups were also divided into the century which they belonged to on a separate column in Excel. Articles between 1984 to 2000 constituted the 20th century, while articles ranging from 2001 and 2022 constituted the 21st century.

A one-way Chai Square was conducted to gain results on significant differences in the number of published articles from high-, middle- and low-income countries. A Cramer's V was computed to assess the strength of the relationship between two variables. Similarly, a Chai Square was used to examine our hypothesis relating to the mentioning of pharmaceutical drugs in articles across year groups.

A random sampling of articles from both PubMed and PsycArticles was completed to ensure that 202 articles were read. We read and analyzed 202 articles (N=202) from both PubMed and PsycArticles. Precisely, 103 articles (N=103) were assessed from PubMed and 99 articles (N=99) were selected from PsycArticles. Fifty-seven articles (N=57) were from the 20th century and 145 articles (N=145) were from the 21st century. Additionally, articles published in the 2010s (N=75) were most read and analyzed in this study.

RESULTS

Alzheimer's Disease in Scientific Literature

There was a significantly higher number of articles discussing Alzheimer's disease in this study compared to articles that did not discuss Alzheimer's disease $\chi^2 (1) = 64.337, P < .001$. Out of the 202 articles read, 158 articles ($N=158$; 78.2%) discussed Alzheimer's disease, while 44 articles ($N=44$; 21.8%) did not discuss Alzheimer's disease. These results can be seen in Figure 1. Despite this, there was no significant difference between high-, middle- and low-income countries discussing Alzheimer's disease in published research $\chi^2 (1, N=202) = .030, P = .862$. Therefore, the discussion of Alzheimer's disease was significant amongst all regions of the world regardless of the country's income. Alzheimer's disease did not increase significantly throughout the year groups $\chi^2 (3, N=202) = 1.372, P = .712$. A Cramer's V ($V = .082$) showed that there was a weak relationship between the year group and the discussion of dementia.

Between the years of 1984 and 1993, 70.6% of articles discussed Alzheimer's disease whereas between 1994 and 2003, it was discussed in 80.8% of the articles. In articles published between the years of 2004 and 2013, 74.5% discussed Alzheimer's disease, while 80.2% of articles between the years of 2014 and 2022 discussed it. There were no significant differences in articles discussing Alzheimer's disease between the 20th and 21st century, $\chi^2 (1, N=202) = .049, P = .825$. A Cramer's V value came at .016 ($V = .016$) indicating a weak relationship between these variables.

A Cochran's Q proved that Alzheimer's disease was discussed in low- and middle-income countries significantly more than other forms of dementia $\chi^2 (4) = 20.216, P < .001$. Amongst the articles discussing dementia from middle- and low-income countries, Alzheimer's disease was the most common form of dementia discussed ($N=12, 80\%$) followed by vascular dementia ($N=7, 47\%$), dementia ($N=3, 20\%$), frontotemporal dementia ($N=2, 13\%$) and Lewy body dementia ($N=2, 13\%$).

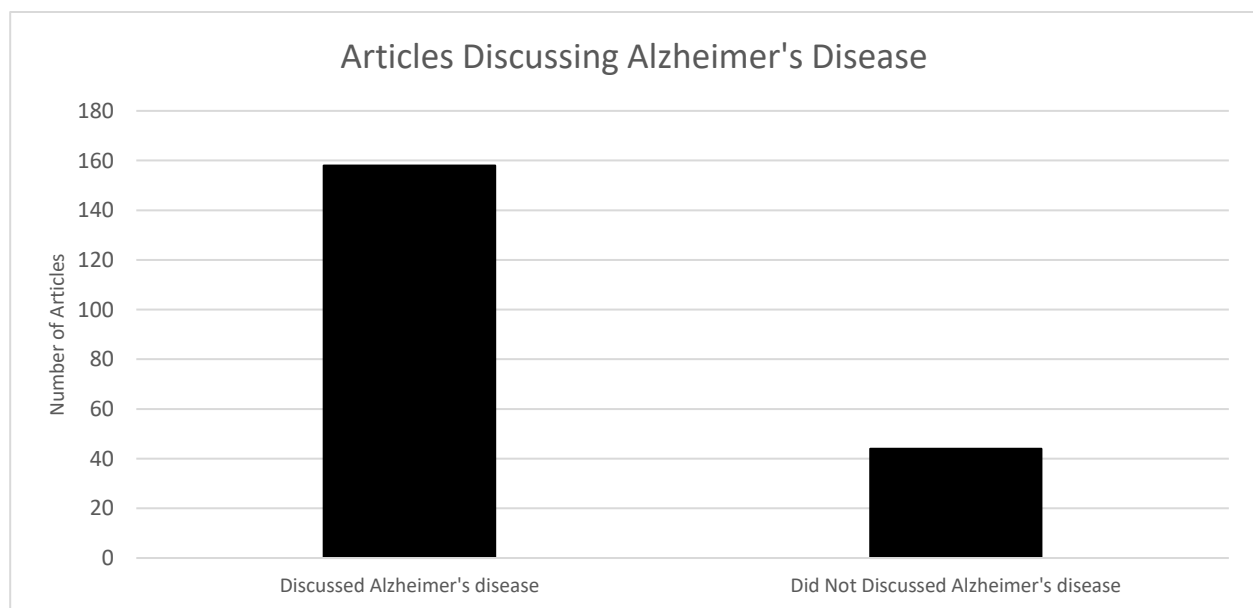


Figure 1: Articles discussing Alzheimer's Disease.

Note. Articles discussing Alzheimer's disease opposed to those not discussing Alzheimer's disease are compared in a bar graph.

Hypothesis on Dementia Across High-, Middle- and Low-Income Countries

The one-way chi square proved that there was a significantly higher number of articles analyzed in this study from high income countries $\chi^2 (1) = 146.55, P < .001$. Specifically, 92.1 percent of articles (N=186) were from high income countries opposed to 7.9 percent (N=16) from middle- and low-income countries. The most common source countries for the articles read in this study were the United States of America (N=96), the United Kingdom (N=20), Germany (N=17), Canada (N=10) and Australia (N=8). Other high-income countries for the author of the articles analyzed included the Netherlands (N=6), Italy (N=6) and Spain (N=4). The most common low- and middle-income source countries where China (N=7), South Korea (N=3), India (N=2) and Brazil (N=2). Other low- and middle-income source countries include Indonesia (N=1) and South Africa (N=1). A full list of the source countries gathered in this study can be seen in Table 1. Furthermore, in middle- and low-income countries Alzheimer's disease was discussed more frequently than any other form of dementia.

There was no significant difference between high-, middle- and low-income countries discussing vascular dementia $\chi^2 (3, N=202) = 1.944, P = .163$. There were 70.6% of articles published from high income countries that did not discuss vascular dementia, while 53.3% of articles from middle- and low-income countries did not discuss this disease. Additionally, 29.4% of articles published from high income countries discussed vascular dementia. Surprisingly, there were more published articles (46.7%) from low- and middle-income countries discussing vascular dementia.

Regarding the discussion of frontotemporal dementia in published research, there was no significant differences between high-, middle- and low-income countries $\chi^2 (3, N=202) = .030, P = .864$. Precisely, 15% of articles published from high income countries discussed frontotemporal dementia, while 13.3% of articles published from middle- and low-income countries discussed it.

Furthermore, there was no significant differences amongst articles discussing Lewy body dementia between high-, middle- and low-income countries $\chi^2 (1) = 1.586, P = .208$. For middle- and low-income countries, only 40 percent of articles assessed discussed Lewy body dementia. On the other hand, 25.1% of articles published from high income countries discussed Lewy body dementia.

Pharmacological Treatment in Published Research

Another two-way chi square proved that the discussion of pharmaceutical drugs in published research has not increased significantly over time $\chi^2 (3, N=202) = 3.72, P = .292$. Furthermore, a Cramer's V of .136 ($V \in .136$) proved that there was a weak relationship between pharmaceutical drugs and the year group of the articles. Between 1984 and 1993, 35.3% of articles discussed pharmacological treatments, which was the lowest amongst all year groups. Additionally, 61.5% of articles between 1994 and 2003 discussed pharmacological treatments. This year group (1994 to 2003) had the highest prevalence of articles discussing pharmacological treatment amongst all year groups. Between 2004 to 2013, 51.1% of articles discussed pharmacological treatment, while 53.3% of articles between 2014 and 2022

discussed drugs. There was no significant difference in articles discussing drugs between the 20th and 21st century, $\chi^2 (1, N=202) = .626, P=.429$.

A two-way chi square showed that the discussion of pharmaceutical drugs did not differ significantly between high-, middle- and low-income countries $\chi^2 (1, N=202) = 1.181, P=.277$. Furthermore, 54.5% of articles in high income countries discussed pharmacological treatment as a treatment for dementia, contrary to 40% of articles in middle- and low-income countries. In addition, 60% of articles in both middle- and low-income countries did not include discussion on pharmaceutical drugs, while 45.5% of articles in high income countries did not discuss pharmaceutical drugs. These results can be seen in Figure 2. A Cramer's V of .076 ($V \in .076$) indicated that there was a weak relationship between the source countries income and the discussion of pharmacological treatment.

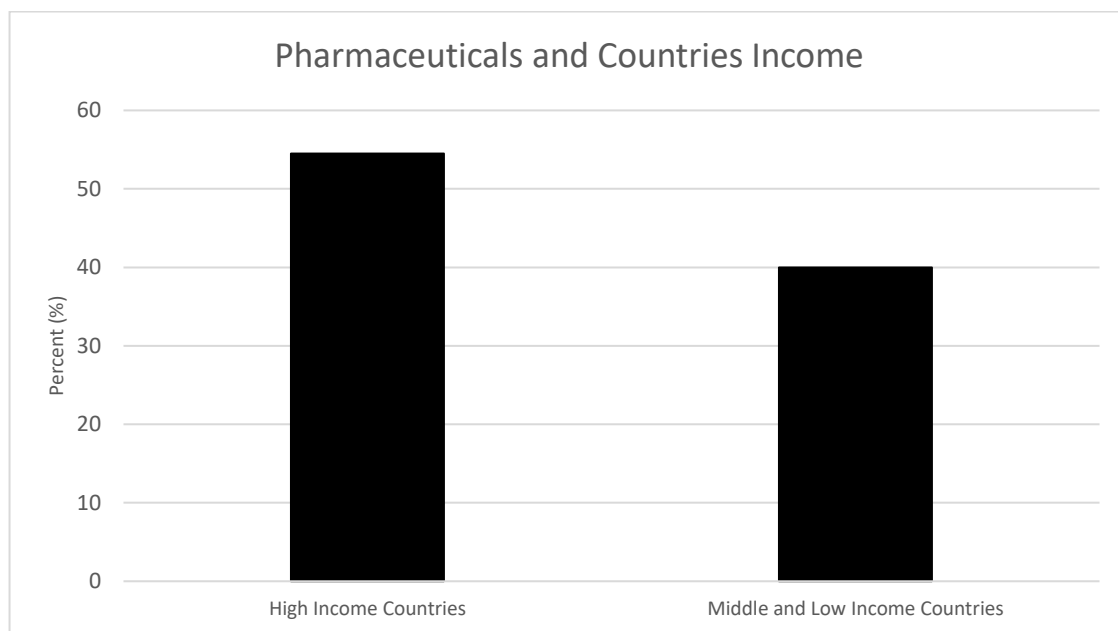


Figure 2: The graph below shows the percent of articles from the income of countries discussing pharmaceutical drugs in their study.

Note. As seen in the graph, there was a higher percentage of articles from High Income countries discussing pharmaceutical drugs than that of middle- and low-income countries. 54.5% of articles from high income countries discuss pharmaceutical drugs opposed to 40% of articles from middle- and low-income countries discussing drugs.

Comorbid Diseases of Dementia in Published Research

The results in this study indicate that comorbid diseases discussed in articles have not increased significantly across the year groups $\chi^2 (3, N=202) = 5.35, P=.148$. Furthermore, a Cramer's V value of .163 ($V \in .163$) showed that there is a weak relationship between both variables. Between 2004 and 2013, 74.5% of articles discussed comorbid diseases of dementia. Between the years of 2014 and 2022, 73.3% of articles discussed comorbid diseases. Amongst articles in the 20th century, 33.3% of articles did not discuss comorbidities of dementia, whereas 66.7% of articles discussed it. Amongst articles in the twenty first century, 73.6% of articles discussed comorbid diseases of dementia, while 26.4% of articles did not discuss this topic.

There was no significant difference between the 20th and 21st century discussing comorbidities $\chi^2 (1, N=202) = 2.55, P=.110$. Depression was the most common comorbid disease of dementia discussed amongst articles. Precisely, 61 articles ($N=61$) discussed depression as either a comorbid or secondary disease of dementia. Furthermore, many articles discussed psychosis as a secondary diagnosis to dementia ($N=12$). Cerebrovascular disease was another common comorbid disease of dementia ($N=12$). Parkinson's disease was also a common comorbidity of dementia within published literature ($N=29$).

Hypothesis Regarding the Diagnostics of Dementia

Between the 20th and 21st century, there were no significant differences in articles discussing brain scans $\chi^2 (1, N=202) = .134, P=.715$. A Cramer's V value of .026 ($V \in .026$) proved that there was no significant relationship between both variables.

Additionally, there was no significant differences between the four separate year groups regarding diagnostics of dementia $\chi^2 (1, N=202) = .989, P=.804$. A Cramer's V value of .070 ($V \in .070$) indicated that there was a poor relationship between the year groups and whether a diagnostic method of dementia was discussed or not. There was also no significant difference between a country's income and incorporation of brain scans $\chi^2 (1, N=202) = .973, P=.324$.

There was no significant difference between high-, middle- and low-income countries and the discussion of diagnostics $\chi^2 (1, N=202) = 1.134, P=.287$. A Cramer's V value of .075 ($V \in .075$) was computed. Diagnostics were discussed in 75.4% of high-income countries and in 86.7% of articles from middle- and low-income countries. These results can be seen in Figure 3.

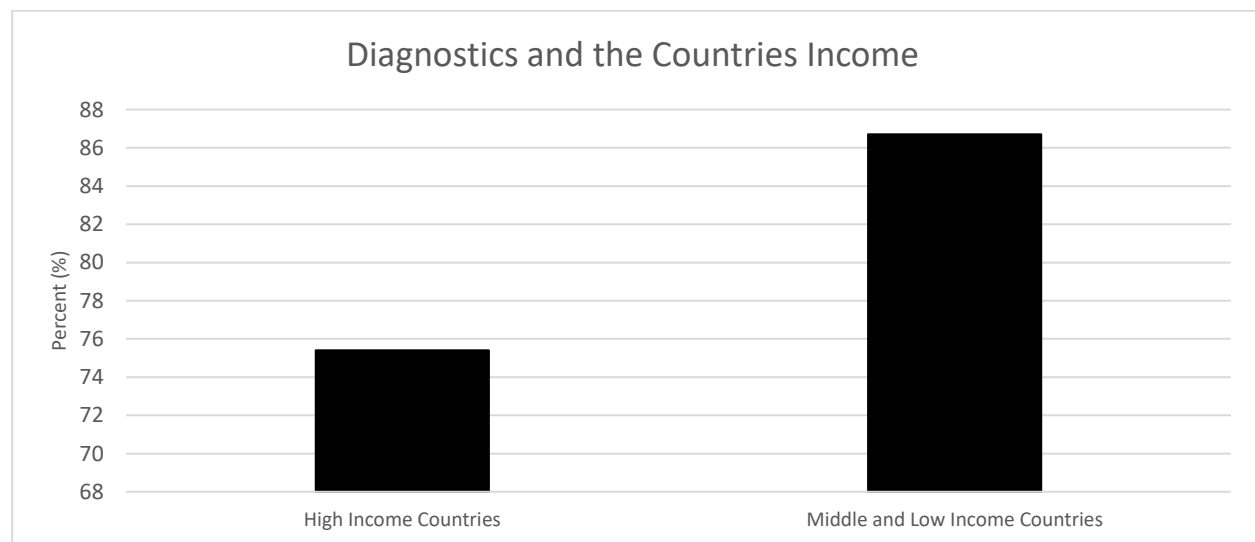


Figure 3: Percentage of articles from each region discussing diagnostics.

Note. There was a higher percentage of articles from middle- and low-income countries discussing diagnostics. As mentioned, this difference was not statistically significant.

Hypothesis on the Causes of Dementia

There were a significant number of articles that expressed no beliefs on the topic of dementia $\chi^2, (3, N=202) = 86.59, P<.001$. There were no significant differences in beliefs discussed

between the 20th and 21st century χ^2 , (3, N=202) =7.2, P=.066. A Cramer's V proved that there was no significant relationship between both variables ($V \in .189$).

As seen in Figure 3, no beliefs on the cause of dementia were the most common belief in 100 articles (N=100). This was followed by 58 articles (N=58) discussing both environmental and biological factors as a cause of dementia. There were 33 articles (N=33) analyzed that discussed solely biological factors as the cause of dementia. Finally, 11 articles (N=11) discussed solely environmental factors as the cause of dementia.

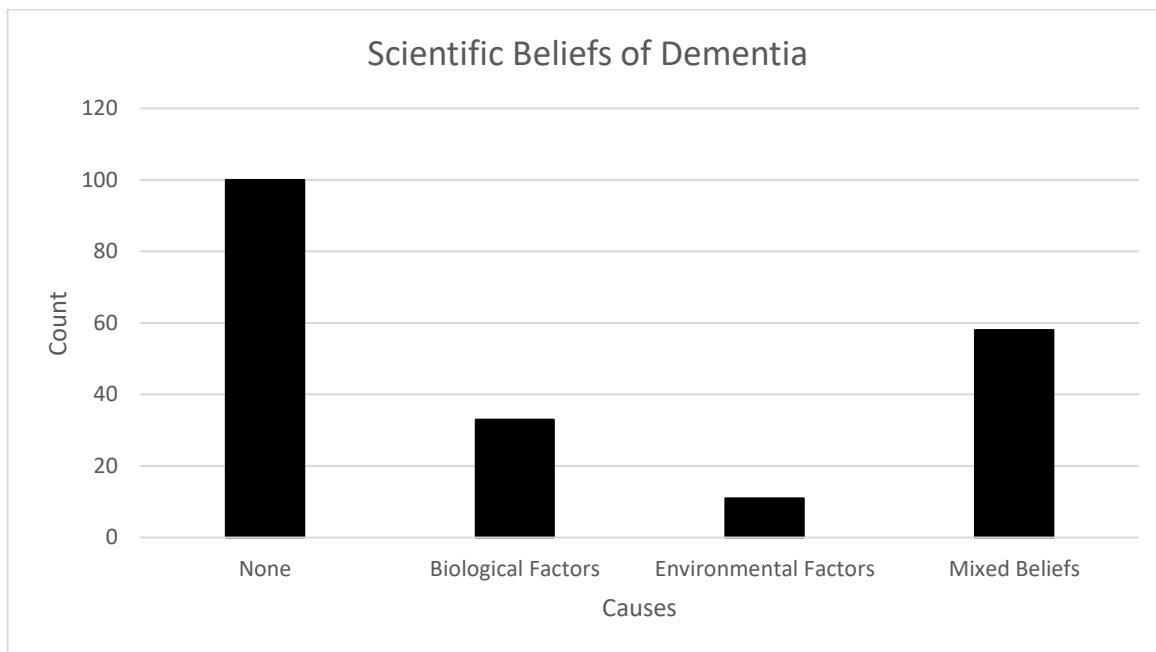


Figure 3: Causes of dementia expressed in articles.

Note. As seen in the bar graph above, a significant number of articles did not discuss potential causes of dementia. Mixed Beliefs were also prevalent in the articles assessed. Environmental factors were the least common.

DISCUSSION

Summary

The results collected in this study indicate that perspectives on dementia have not changed significantly over time. Therefore, we rejected the fifth hypothesis as it was predicted that perspectives would have changed in the 21st century. The highest percentage of articles discussing dementia through biological causes (23.5%) were between 1984 and 1993. Contrary to this, no beliefs on the cause of dementia were most expressed between 2014 to 2022 (57%). The discussion of environmental factors as a cause of dementia was most common between the years of 1984 and 1993 with 11.8% of articles. Between the years of 1994 and 2003 had the highest percentage of articles discussing both environmental and biological factors as a cause of dementia (32.7%).

Although 49.5% of articles (N=100) did not discuss causes of dementia, most scientists believe that its development is influenced by both genetic and environmental factors. In fact, 28.7% of

articles discussed both environmental and biological factors as potential causes of dementia. Thirty-three articles (16.3%) discussed biological causes on the development of dementia, while only 11 articles (5.4%) discussed environmental factors as potential influences. Many scientific studies that examined environmental factors as a cause of dementia examined air quality, toxic heavy metals, trace elements, occupational related exposures, and miscellaneous environmental factors. Contrary to this, most scientific articles that examined biological factors as a cause of dementia include inheritance, age, heritage, and the presence of numerous alleles involved in the development of the disease. A possible cause for most scientific articles examining dementia through both environmental and biological factors could be the increased prevalence of various biological methodologies and technologies. For example, brain scanning techniques such as the MRI, fMRI, CT, and PET scans have increased in usage since the 1960s within the fields of research and medicine (Portnow, et al, 2013).

The highest proportion of articles discussing pharmaceutical drugs were found in articles published between 2000 to 2009. A potential cause for this result is that the rate of prescription drugs had increased significantly during this time (Kaitin & DiMassi, 2010). The results in this study demonstrated that there was no significant difference regarding the discussion of pharmaceutical drugs over time. This is understandable as the use of pharmaceutical treatments for neurological disease increased significantly during the 1970s (Grabowski & Vernon, 2000). There were no significant differences between high-, middle- and low-income countries discussing pharmaceutical drugs. Due to this, the third hypothesis in this study was rejected.

Furthermore, the inclusion of brain scans within published literature has not increased significantly between the 20th and 21st centuries $\chi^2(1, N=202) = .134, P=.715$. The MMSE, DSM, ICD and the Activity of Daily Living Scale were the most common diagnostics discussed in the 202 articles analyzed. The MMSE is the most used clinical tool to identify dementia (Swanson & Carnahan, 2007). These four diagnostics are beneficial in making a diagnosis of dementia and are commonly used to gain insight to dementia and comorbid diseases (Bucks, et al, 1996; Prince, et al, 2003; Schultz-Larson, et al, 2007).

Comorbid diseases with dementia are particularly common. These may accelerate progression towards a state cognitive and functional impairments that lead to poor treatments and the underdiagnosis of dementia (Solomon, et al, 2011). The most common comorbidities amongst all forms of dementia are depression and diabetes (Poblader-Plou, et al, 2014). This can be observed in the results as 30.1% of articles discussed depression as a comorbid disease. There was 4.95% of articles discussing diabetes in this study. Despite this, the results in this study proved that there were no significant differences in articles discussing comorbid diseases between the 20th and 21st century.

As the results revealed, Alzheimer's disease is discussed in scientific articles significantly more than any other form of dementia. Specifically, 78.2% (N=158) of articles discussed Alzheimer's disease. This is not surprising as Alzheimer's disease is responsible for most individuals exhibiting signs and symptoms of dementia (Swanson & Carnahan, 2007). Clinically, Alzheimer's disease accounts for over 65% of dementia cases (Swanson & Carnahan, 2007). The prevalence of Alzheimer's disease increases with advancing age (Swanson & Carnahan, 2007). A possibility for this could be that Alzheimer's disease is the most diagnosed form of dementia

across all regions worldwide (DeTure & Dickson, 2019). The continuing expansion of life expectancy could have led to the growing number of patients diagnosed with Alzheimer's disease, which in turn led to an increase in research on the disease.

The results in this study show that most of the research on dementia is published from high income countries. This reflects the need for research on dementia in developing countries. The United States of America has a strong influence on dementia research and other neurological diseases (Pickett & Brayne, 2019).

Limitations

Limitations of this study include a low number of articles from middle- and low-income countries. While we assessed differences in beliefs between high-, middle- and low-income countries, there were fewer articles published from middle- and low-income countries (only 7.9% of articles). In this study, articles from the United States of America constituted 47% of articles. This made it challenging to assess differences amongst beliefs on the cause of dementia. A further limitation is that only four percent of articles came from the 1980s. Furthermore, a significant number of articles analyzed were between 2014 and 2022 (42.6%). Only 23.3% of articles analyzed in this study ranged between 2004 and 2013, while 25.7% of articles were from 1994 to 2003. Having a proportionate number of articles from each year group would have given us a broader perspective on how treatments, pharmacological treatments and beliefs have changed over history. Another limitation is that there was less than four decades worth of scientific analysis. With the expansion of diagnostic methods in the 1960s and the introduction of more than a hundred new pharmaceutical drugs in the 1970s, gaining results from the 1950s would have been intriguing (Grabowski & Vernon, 1990).

Future Directions

Future directions that can be extended from this research can include additional forms of dementia. For example, HIV associated dementia, alcohol related dementia, and childhood dementia. As mentioned previously, years of analysis should begin in 1950 as there have been significant additions regarding treatments and diagnostics since then. For example, brain scans have become a more common diagnostic method since the 1980s (Kindermann, et al, 2002). Additionally, future research could examine and compare the effects of drug types (for example, cholinesterase inhibitors, antidepressants, acetylcholinesterase inhibitors) on symptoms of dementia within scientific literature. These different classifications of pharmaceutical drugs all have separate effects on the development of symptoms related to dementia (Tanzi, 2019). For example, exposure to anticholinergic drugs have been shown to increase the risk of developing progressive dementia (Tanzi, 2019). The effects of the drug classification alongside the form of dementia would provide intriguing results.

The results in this study demonstrated the manners in which dementia and its related factors have been examined within published research. Such results can provide an indicator for the current state of how scientists and research corporations are examining dementia. For example, the results proved that Alzheimer's disease was discussed more frequently than Lewy body dementia, vascular dementia, and frontotemporal dementia. Through this study, scientists can better understand how research on the cause of dementia has progressed. Additionally, these results will encourage both scientific creativity and scientific communication amongst professionals worldwide.

References

- Boscart, V. M., McNeill, S., & Grinspun, D. (2019). Dementia care in Canada: Nursing recommendations. *Canadian Journal on Aging / La Revue Canadienne Du Vieillissement*, 38(03), 407–418. <https://doi.org/10.1017/s071498081800065x>
- BUCKS, R. S., ASHWORTH, D. L., WILCOCK, G. K., & SIEGFRIED, K. (1996). Assessment of activities of daily living in dementia: Development of the Bristol activities of Daily Living Scale. *Age and Ageing*, 25(2), 113–120. <https://doi.org/10.1093/ageing/25.2.113>
- Clarnette, R. M., & Patterson, C. J. (1994). Hypothyroidism: Does treatment cure dementia? *Journal of Geriatric Psychiatry and Neurology*, 7(1), 23–27. <https://doi.org/10.1177/089198879400700105>
- DeTure, M. A., & Dickson, D. W. (2019). The neuropathological diagnosis of alzheimer's disease. *Molecular Neurodegeneration*, 14(1). <https://doi.org/10.1186/s13024-019-0333-5>
- Di Feo, G. M., & O'Connell, M. (2022). Scientific perspectives on autism over time. *Advances in Social Sciences Research Journal*, 9(12), 161–174. <https://doi.org/10.14738/assrj.912.13552>
- Di Feo, G., & Whissell, C. (2020). Changes in the style and contents of abstracts from the Journal of Consulting and clinical psychology between the 1960s and the 2010s. *Advances in Social Sciences Research Journal*, 7(10), 546–551. <https://doi.org/10.14738/assrj.710.9215>
- Gatz, M., Mortimer, J. A., Fratiglioni, L., Johansson, B., Berg, S., Reynolds, C. A., & Pedersen, N. L. (2006). Potentially modifiable risk factors for dementia in identical twins. *Alzheimer's & Dementia*, 2(2), 110–117. <https://doi.org/10.1016/j.jalz.2006.01.002>
- Grabowski, H., & Vernon, J. (2000). The determinants of Pharmaceutical Research and Development Expenditures. *Journal of Evolutionary Economics*, 10(1–2), 201–215. <https://doi.org/10.1007/s001910050012>
- Lee, A. H., & Weintraub, D. (2012). Psychosis in parkinson's disease without dementia: Common and comorbid with other non-motor symptoms. *Movement Disorders*, 27(7), 858–863. <https://doi.org/10.1002/mds.25003>
- Lopes, M. A., Hototian, S. R., Reis, G. C., Elkis, H., & Bottino, C. M. (2007). Systematic review of dementia prevalence - 1994 to 2000. *Dementia & Neuropsychologia*, 1(3), 230–240. <https://doi.org/10.1590/s1980-57642008dn10300003>
- Pistollato, F., Ohayon, E. L., Lam, A., Langley, G. R., Novak, T. J., Pamies, D., Perry, G., Trushina, E., Williams, R. S. B., Roher, A. E., Hartung, T., Harnad, S., Barnard, N., Morris, M. C., Lai, M.-C., Merkley, R., & Chandrasekera, P. C. (2016). Alzheimer disease research in the 21st Century: Past and current failures, new perspectives, and funding priorities. *Oncotarget*, 7(26), 38999–39016. <https://doi.org/10.18632/oncotarget.9175>
- Poblador-Plou, B., Calderón-Larrañaga, A., Marta-Moreno, J., Hanco-Saavedra, J., Sicras-Mainar, A., Soljak, M., & Prados-Torres, A. (2014). Comorbidity of dementia: A cross-sectional study of primary care older patients. *BMC Psychiatry*, 14(1). <https://doi.org/10.1186/1471-244x-14-84>
- Portnow, L. H., Vaillancourt, D. E., & Okun, M. S. (2013). The history of Cerebral Pet Scanning: From physiology to cutting-edge technology. *Neurology*, 80(10), 952–956. <https://doi.org/10.1212/wnl.0b013e318285c135>
- Prince M, Acosta D, Chiu H, Scazufca M, Varghese M (2003) Dementia diagnosis in developing countries: a cross-cultural validation study. *The Lancet* 361: 909–917.
- Pickett, J., & Brayne, C. (2019). The scale and profile of Global Dementia Research Funding. *The Lancet*, 394(10212), 1888–1889. [https://doi.org/10.1016/s0140-6736\(19\)32599-1](https://doi.org/10.1016/s0140-6736(19)32599-1)

Hampel, H., Toschi, N., Babiloni, C., Baldacci, F., Black, K. L., Bokde, A. L. W., Bun, R. S., Cacciola, F., Cavado, E., Chiesa, P. A., Colliot, O., Coman, C.-M., Dubois, B., Duggento, A., Durrleman, S., Ferretti, M.-T., George, N., Genthon, R., Habert, M.-O., ... Lista, S. (2018). Revolution of alzheimer precision neurology. *Passageway of Systems Biology and neurophysiology*. *Journal of Alzheimer's Disease*, 64(s1). <https://doi.org/10.3233/jad-179932>

Smith-Bindman, R., Kwan, M. L., Marlow, E. C., Theis, M. K., Bolch, W., Cheng, S. Y., Bowles, E. J., Duncan, J. R., Greenlee, R. T., Kushi, L. H., Pole, J. D., Rahm, A. K., Stout, N. K., Weinmann, S., & Miglioretti, D. L. (2019). Trends in use of medical imaging in US Health Care Systems and in Ontario, Canada, 2000-2016. *JAMA*, 322(9), 843. <https://doi.org/10.1001/jama.2019.11456>

Solomon, A., Dobranici, L., Kåreholt, I., Tudose, C., & Lăzărescu, M. (2011). Comorbidity and the rate of cognitive decline in patients with alzheimer dementia. *International Journal of Geriatric Psychiatry*, 26(12), 1244–1251. <https://doi.org/10.1002/gps.2670>

Schultz-Larsen, K., Lomholt, R. K., & Kreiner, S. (2007). Mini-mental status examination: A short form of MMSE was as accurate as the original MMSE in predicting dementia. *Journal of Clinical Epidemiology*, 60(3), 260–267. <https://doi.org/10.1016/j.jclinepi.2006.06.008>

Swanson, K. A., & Carnahan, R. M. (2007). Dementia and Comorbidities: An overview of diagnosis and management. *Journal of Pharmacy Practice*, 20(4), 296–317. <https://doi.org/10.1177/0897190007308594>

Sobczak, S., Olff, M., Rutten, B., Verhey, F., & Deckers, K. (2021). Comorbidity rates of posttraumatic stress disorder in dementia: A systematic literature review. *European Journal of Psychotraumatology*, 12(1). <https://doi.org/10.1080/20008198.2021.1883923>

Tanaka, M., Török, N., & Vécsei, L. (2022). Novel pharmaceutical approaches in dementia. *NeuroPsychopharmacotherapy*, 2803–2820. https://doi.org/10.1007/978-3-030-62059-2_444

Tanzi, M. G. (2019). Anticholinergic drug exposure increases risk of dementia. *Pharmacy Today*, 25(9), 4. <https://doi.org/10.1016/j.ptdy.2019.08.028>

Kaitin, K. I., & DiMasi, J. A. (2010). Pharmaceutical innovation in the 21st Century: New drug approvals in the first decade, 2000–2009. *Clinical Pharmacology & Therapeutics*, 89(2), 183–188. <https://doi.org/10.1038/clpt.2010.286>

Karantzoulis, S., & Galvin, J. E. (2011). Distinguishing alzheimer's disease from other major forms of dementia. *Expert Review of Neurotherapeutics*, 11(11), 1579–1591. <https://doi.org/10.1586/ern.11.155>

Kindermann, S. S., Dolder, C. R., Bailey, A., Katz, I. R., & Jeste, D. V. (2002). Pharmacological treatment of psychosis and agitation in elderly patients with dementia. *Drugs & Aging*, 19(4), 257–276. <https://doi.org/10.2165/00002512-200219040-00002>

Koyama, A., Steinman, M., Ensrud, K., Hillier, T. A., & Yaffe, K. (2013). Ten-year trajectory of potentially inappropriate medications in very old women: Importance of cognitive status. *Journal of the American Geriatrics Society*, 61(2), 258–263. <https://doi.org/10.1111/jgs.12093>

Zagórska, A., Czopek, A., Fryc, M., Jaromin, A., & Boyd, B. J. (2023). Drug Discovery and Development targeting dementia. *Pharmaceuticals*, 16(2), 151. <https://doi.org/10.3390/ph16020151>