SSM - Mental Health 2 (2022) 100123

Contents lists available at ScienceDirect

SSM - Mental Health

journal homepage: www.journals.elsevier.com/ssm-mental-health

Spinning lobotomy: A conventional content analysis of articles by the pioneers of the procedure in the United States

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ARTICLE INFO

Keywords:
Mental health
Bioethics
Narrative analysis
History of medicine
Social inequalities in health
Mental health services

ABSTRACT

Frontal lobotomy, one of the most controversial procedures of the modern era, was pioneered and promoted by Walter J. Freeman and James W. Watts in the United States. The purpose of this study is to analyze the role of bias and spin in their most impactful medical articles on lobotomy. A summative qualitative content analysis of their articles written between 1944 and 1971 reveals that, despite the lack of endorsement by the U.S. medical establishment, Freeman and Watts gave an overwhelmingly positive depiction of lobotomy along prevailing social, economic, and behavioral norms and needs. These results indicate evidence of both confirmation and social desirability bias by the authors.

1. Introduction

Frontal lobotomy is widely regarded as one of the twentieth century's most controversial procedural innovations for the treatment of psychiatric disorders. A lobotomy operation surgically severs connections in the brain's prefrontal cortex in order to produce its desired effect. While the first lobotomy was conducted in 1935 by António Egas Moniz of Portugal, the procedure did not gain many adherents in the United States until it was "refined" and promoted by American neurologist Walter J. Freeman and neurosurgeon James W. Watts (Persaud, 2005). As pioneers of the procedure in the United States, Freeman and Watts performed nearly 200 frontal lobotomies from 1936 to 1942 and published their first case studies on the operations shortly thereafter (Caruso and Sheehan, 2017). At a time when treatment options for patients with severe mental illness were limited, Freeman and Watts's enthusiastic endorsement of the therapeutic nature of the procedure helped propel lobotomy to a greater acceptance among both the lay and professional public in the United States and around the world, despite the persistent controversies surrounding its invasiveness. Moniz's 1949 Nobel Prize in Medicine, further legitimized the operation and advanced the efforts of Freeman and Watts to promote lobotomy in the United States (Gross and Schäfer, 2011).

Historians attribute the initial enthusiasm for lobotomy to a number of key factors. First, there were a limited number of treatment options available for mental disorders, which was a problem that was amplified by the growing number of psychiatric hospitalizations after World War II. Additionally, the early twentieth century had seen a rise in new somatic treatments for mental disorders, ranging from malaria therapy for neurosyphilis to differing forms of convulsive therapy using electric current, chemicals, or drugs such as insulin. These procedures were viewed by physicians and the general public as acceptable, which provided an optimistic outlook on lobotomy early on. Lobotomy was viewed as helpful because it granted patients the opportunity to resume their lives in their communities and outside the confines of hospitals. And amongst the patients who could not be discharged post-procedure, their behavior was noted to be much more manageable (Raz, 2013). Eventually, poor patient outcomes, negative depictions of lobotomy in the media, and increased regulatory and ethical scrutiny contributed to lobotomy's diminishing popularity (Caruso and Sheehan, 2017).

Medical ethics are based on a set of principles that professionals can refer to in cases of uncertainty or dispute. These principles include the respect for patient autonomy, non-maleficence, beneficence, and justice (Beauchamp, 2013). According to the American Medical Association's Code of Medical Ethics pertaining to Research and Innovation, "Physicians who are involved in clinical research have special responsibilities as investigators to protect the rights, safety and welfare of research participants that include matters of study design, informed consent and

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https://doi.org/10.1016/j.ssmmh.2022.100123
Received 7 December 2021; Received in revised form 24 May 2022; Accepted 28 May 2022
Available online 11 June 2022

selection of participants" and, furthermore, "Research involving human participants should be conducted in a manner that minimizes risks and avoids unnecessary suffering. Participants must be able to make informed decisions about whether to participate or continue in a given protocol" (American Medical Association). It should be noted that medical ethics are not static and what was considered "good ethics" a hundred years ago may not be considered so today (Markose et al., 2016).

Advances in psychiatric pharmacotherapy that began with the advent of chlorpromazine further led to the decline of invasive interventions, such as psychosurgery, after the 1950s (Robison et al., 2012). Despite the diminishing acceptance of lobotomy in the medical community in the face of "devastating postoperative complications, including intracranial hemorrhage, epilepsy, alterations in affect and personality, brain abscess, dementia, and death" (Caruso and Sheehan, 2017), Freeman continued to promote the procedure by publishing research that demonstrated its efficacy in treating severe mental illnesses over more accepted and less invasive treatment options until he was wholly ostracized from professional circles in the early 1970s. The lack of professional regulations and reporting mechanisms on surgical complications in this period enabled the authors to be selective about how they presented poor outcomes. This included case reports and opinion pieces since many high-profile journals did not begin to adopt rigorous external refereeing until the 1960s, thereby giving opinion pieces and case reports the same weight as systematic research studies that underwent a similar editorial review (Baldwin, 2015). Lobotomy's decades-long hold over the medical community remains to be examined through the lens of quantitative and mixed method research, particularly to assess the role of bias in popularizing an operation that is now considered to have done more harm than good.

Investigator bias, particularly the distortion of findings, has an oversized presence in published biomedical research (Ioannidis, 2016), with potentially disastrous consequences for patients when it is unrecognized. An often cited definition of bias in research is "any process at any stage of inference which tends to produce results or conclusions that differ systematically from the truth" (Sackett, 1979). The scholarly discourse on shortfalls in the integrity of published research has often focused on standardizing its definition and measuring its occurrence (John et al., 2012; Komic' et al., 2015, Horbach and Halffman, 2017; and Salwen, 2015). The analysis of the language used in publishing nonscientific innovations has often been overlooked in this literature, despite the fact that the language utilized in disseminating information on experiments and their results plays an oversized role in the adoption of novel scientific advances, a phenomenon called innovation diffusion (Webber and Brown, 2006). A multifactorial model of innovation takes into account the significant role of the language used by the producers of innovation in "adapting the [proposed] innovation to people's tastes and pockets" so as to drive mass adherence (Webber and Brown, 2006 and Brown et al., 1996). Analysis of the rhetoric used in scientific publications allows us to examine the means of innovation diffusion and avenues for possible bias in the way scientific research is communicated to its intended audience.

There are many ways that scientific literature, particularly in the biomedical realm, can be distorted in order to promote a specific innovation. These distortions can be the result of biases, personal idiosyncrasies, incompetence, or spin. The concept of spin in scientific articles has been defined as a conscious or unconscious reporting bias that fails to correctly reflect empirical research, which in turn can affect the impact of a proposed innovation on a targeted audience. This can include misrepresenting methods and results, selectively disclosing outcomes and analysis, and distorting or wholly omitting data that contradicts the investigator's initial hypothesis (Boutron and Ravaud, 2018). According to Boutron and Ravaud, in the competitive environment of medical innovation, reporting positive findings has an oversized influence on research, a phenomenon that makes authors more vulnerable to bias and spin. Spinning scientific findings can have a profound effect on not only shaping the opinion and practices of researchers and physicians, but also that of the media and general public; the latter being more vulnerable to forming opinions based on assertions made by researchers and other subject matter experts.

This study investigates Freeman and Watts's depictions of lobotomy in their most impactful articles in biomedical journals, those that reported quantitative patient data, since scholars agree that the use of quantitative and statistical evidence to back up a claim increases the persuasiveness of a message (Hornikx, 2005). Specifically, using conventional summative qualitative content analysis, this study will examine whether their reports on lobotomy between 1944 and 1971 were biased by overly positive depictions of the procedure and by the social conventions of the era, and if these depictions changed over time with the evolving social and scientific consensus on the procedure. The goal of the content analysis is to define how often positively and negatively charged content is seen within the publications along with an interpretation of what these events mean and the possible reasons for their occurance. A qualitative methodology remains the most appropriate approach to evaluating potential biases in the works of Freeman and Watts given the institutional restrictions on accessing their patients' records due to the protections accorded to the healthcare data of surviving patients that underwent the procedure. This analysis focuses primarily on published sources authored by Freeman and some that were co-authored by Watts. Their partnership ultimately ended in 1947 after disagreements regarding transorbital lobotomy, mainly due to Freeman's decision to perform the procedure unassisted, and in an outpatient setting (Caruso and Sheehan, 2017). Conventional qualitative content analysis is one of the most common methods used in the study of qualitative textual data (Vaismoradi et al., 2013). This systematized research method uses codes and categories to determine the presence and frequency of words, themes, and concepts in the text under scrutiny and, by extension, is ideally suited to shed light on meanings, patterns, and textual emphases that allows for a clearer understanding of an author's intent (Weber, 1990).

2. Methods

2.1. Study identification

Every member of the research team searched PubMed and the Catalogue of the Library of the Surgeon-General's Office (Index-Catalogue) databases for articles authored by Walter J. Freeman or James W. Watts on the subject of lobotomy. Because of the limitations of accessing non-digitized manuscripts and articles, we had a smaller sample size which likely affected the scope and results of this study. The query resulted in one hundred and fifty-six articles. Sixty-one duplicate articles were removed, yielding ninety-five remaining articles. Of these, forty-three articles were not accessible in full text formatting and were excluded from this study. The decision to not include these articles was a pragmatic consideration given both the length of the manuscripts and the fact that they were often not digitized or accessible. The inclusion content criteria of this study required the identified articles to possess both qualitative and quantitative patient data (Fig. 1). This resulted in sixteen articles published between 1944 and 1971; three were published during the 1940s, nine in the 1950s, three in the 1960s and one during the 1970s (Table 1).

2.2. Study selection

The sixteen articles were divided between four reviewers to verify if each article met the inclusion criteria. The articles were then presented to different secondary reviewers to reach consensus on if the article met the inclusion criteria and fit within the scope of our research question. After the full text review, we extracted the following information from the included articles using a standardized data collection form: citation information, title/objective of the article, field of study, and implications of the findings relevant to our research question.

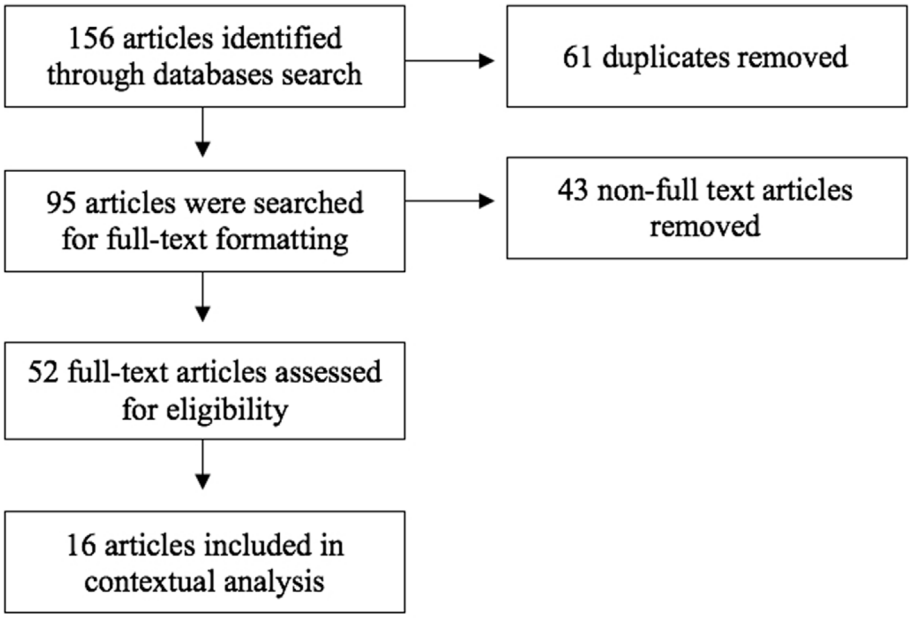

Fig. 1. Article search and selection process for lobotomy patient centric data authored by Freeman and Watts.

Table 1
Summary of the 16 articles identified during a review of the literature published by Freeman and Watts.

Author(s)	Date	Field of Journal	Title
Walter Freeman, James Watts	1944	Neurosurgery	Intelligence Following Prefrontal Lobotomy In Obsessive Tension States
Walter Freeman, James Watts	1946	Medicine	Prefrontal Lobotomy: Survey Of 331 Cases
Walter Freeman	1948	Medicine	Transorbital Lobotomy: Preliminary Report Of 10 Cases
Walter Freeman	1952	Psychiatry	Transorbital Lobotomy: The Problem Of The Thick Orbital Plate
Walter Freeman	1953	Psychiatry	Level Of Achievement After Lobotomy: A Study Of 1000 Cases
Walter Freeman	1953	Psychiatry	Late Results Of Prefrontal Lobotomy: A Study Of Two Hundred Patients Followed Ten To Seventeen Years
Walter Freeman	1954	Medicine	Transorbital Lobotomy In State Mental Hospitals
Walter Freeman	1954	Medicine	West Virginia Lobotomy Project
Walter Freeman	1956	Medicine	Twenty Years of Leucotomy
Walter Freeman	1957	Psychiatry	Frontal Lobotomy 1936–1956: A Follow-Up Study of 3000 Patients From One To Twenty Years
Walter Freeman	1958	Medicine	Psychosurgery: Present Indications And Future Prospects
Walter Freeman	1958	Medicine	Prefrontal Lobotomy: Final Report Of 500 Freeman and Watts Patients Followed For 10 To 20 Years
Walter Freeman	1961	Neurology	Adolescents In Distress: Therapeutic Possibilities Of Lobotomy
Walter Freeman	1962	Medicine	West Virginia Lobotomy Project: A Sequel
Walter Freeman	1967	Psychiatry	Multiple Lobotomies
Walter Freeman	1971	Psychiatry	Frontal Lobotomy In Early Schizophrenia: Long Follow-Up In 415 Cases

2.3. Data methodology

After compiling this initial description of the articles, we conducted a conventional qualitative content analysis. Conventional qualitative analysis is particularly suited to textual studies such as ours when existing theory or research literature on a phenomenon is limited and inductive category development is called for (Kondracki et al., 2002). Our methodology adhered to Mayring's step model of inductive category development (Mayring, 2000).

2.4. Data extraction and categorization

The selected articles were divided between each member of the research team who then systematically examined their assigned articles for specific references to lobotomy. When the word lobotomy was directly or indirectly referenced in the text, the passage referring to the procedure was extracted and condensed into a meaning unit. The meaning unit was then coded with a keyword or phrase derived from the meaning unit itself. A positive (+1), negative (−1), or neutral (0) valence was assigned to the code (keyword/phrase) based on how lobotomy as a procedure was characterized in the condensed meaning unit (Fig. 2). The term "valence" refers to forces that either attract individuals to desired objects or repel them from undesirable ones (Lewin, 1951).

2.5. Data analysis

The condensed meaning units that were related to each other through their subjective content and context were organized into larger groupings or categories (Table 2). We then reviewed the codes, valences, and categories and came to a consensus on a single final set of codes and reached agreement on assigned valences and categories. These codes and categories were then used to identify major overarching themes across the sixteen articles in this study. We used one spreadsheet to organize the passages referring to lobotomy and associated meaning units and codes and another spreadsheet to organize the codes with their associated valences, date of publication, categories and themes. Meaning units that were bimodal in nature, that is representative of both a positive and negative connotation, were deemed neutral and were not included in our graphical analysis of the positive and negative meaning units under each theme between 1944 and 1971.

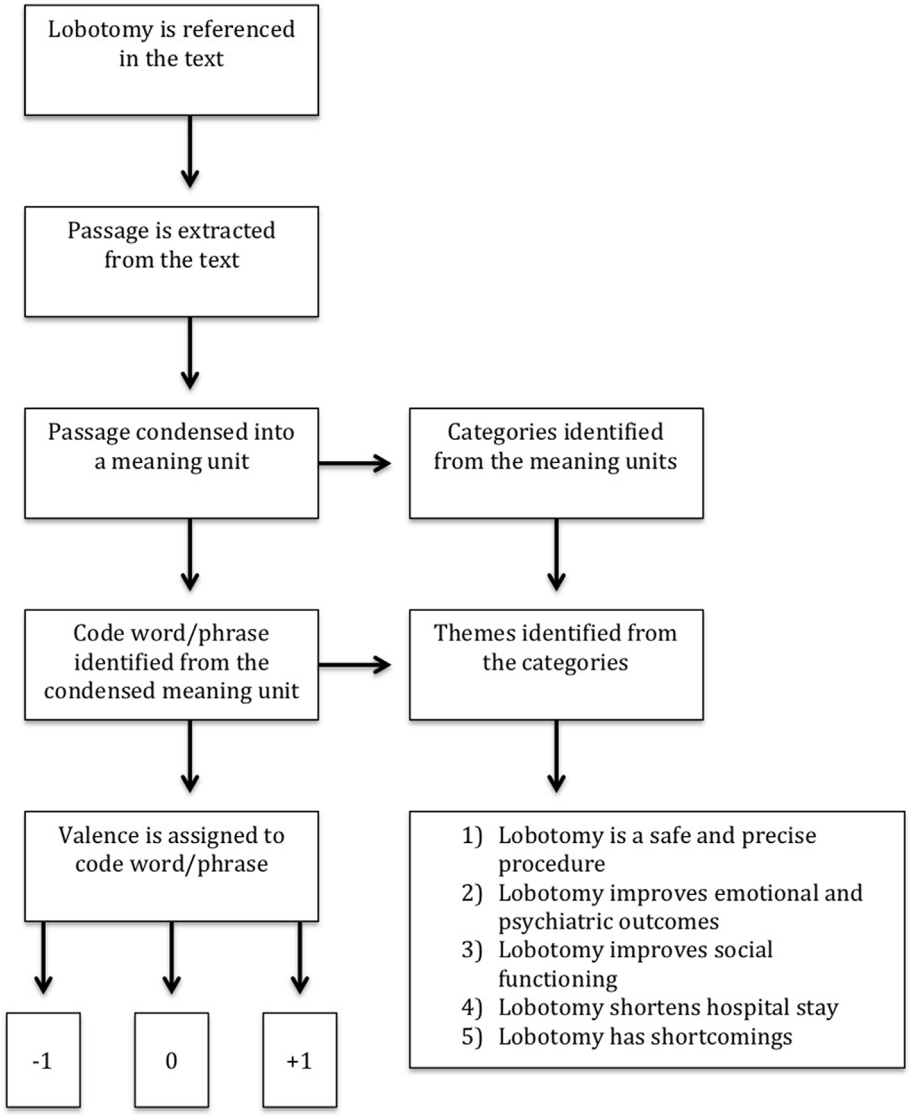

Fig. 2. Framework for data collection. Included in this framework are the five themes from the investigation of the 16 articles that were identified during a review of the literature published by Freeman and Watts.

3. Results

The broad characteristic of the sixteen articles identified during our scoping review and included in our thematic analysis can be seen in Table 1. (Diefenbach et al., 1999; Faria, 2013; Freeman and Watts, 1946; Freeman, 1948, 1952, 1953a, 1953b, 1954, 1957a, 1957b, 1958a, 1958b, 1961, 1962, 1967, 1971; Freeman et al., 1954; Robison et al., 2012) Eight of the articles were published in journals of medicine, six were published in journals of psychiatry, and two were published in journals of neurology/neurosurgery. Thirteen of the articles were published in American journals and three were published in European journals. Walter Freeman was listed as an author on all sixteen articles while James Watts was listed as a co-author on two. Ten of the articles were observational studies, five were case reports, and one was an opinion editorial. All sixteen articles provided both qualitative and quantitative data.

We identified five common themes that Freeman and Watts used to promote lobotomy within the sample of identified articles. A positive valence was ascribed to codes that referred to lobotomy in a positive manner, while a negative valence was ascribed to codes that associated lobotomy with poor outcomes and negative connotations. Neutral valences were ascribed when the meaning unit did not evoke a positive or negative connotation of lobotomy, such as a purely statistical statement without any positive or negative connotation. The positive valence trajectory over time across all themes displayed an initial code count of 12 in 1940–1944, and showed a maximum code count of 108 in 1955–1959, with a minimum code count of 9 in 1945–1949. The negative valence trajectory over time across all themes displayed an initial code count of 3 in 1940–1944, and showed a maximum code count of 52 in 1955–1959, with a minimum code count of 3 in both 1940–1944 and 1945–1949 (Fig. 3). Approximately 22% of the codes (or 88 out of 380 codes) had neutral valences across all the analyzed articles.

3.1. *Lobotomy is a safe and precise procedure*

The technical attributes of lobotomy as a safe and precise procedure was identified as a theme. This theme encompassed condensed meaning units and codes that pertained to the performance and nature of lobotomy as a surgical procedure. Surgical technique was identified as a category derived from meaning units in this theme detailing the anatomical approach to the surgical procedure, ease of operation, and rhetoric that explicitly stated that the procedure was ‘safe, precise, and accurate’ or other terms that characterized the procedure. Surgical complications were established as a category and encompassed

Table 2
Definitions of the themes and categories that were derived from the contextual analysis.

Themes and Categories	Definition
Lobotomy is a safe and precise procedure	
Surgical Technique	Meaning units pertaining to the performance of lobotomy
Surgical Complications	Meaning units pertaining to the mortality and damaging consequences or results of lobotomy
Timing of Procedure	Meaning units pertaining to the temporal indication for performing lobotomy, such as age, duration of hospitalization or symptoms
Ease of Operation	Meaning units pertaining to prompt recovery following lobotomy
Lobotomy improves emotional and psychiatric outcomes	
Relief of Distress	Meaning units pertaining to the anxiolytic/calming effects of lobotomy
Reduction of Violence	Meaning units pertaining to the subsequent decrease in violent behavior
Improvement of Psychiatric Conditions	Meaning units related to prognosis
Diagnoses Associated with Positive Improvement	Meaning units indications for the procedure
Effects on Personality	Meaning units pertaining to alterations in personality after the procedure
Lobotomy improves social functioning	
Integration into Society	Meaning units relating to a patient's ability to return home after being lobotomized and their level of fit within their household and community
Intellectual Functioning	Meaning units pertaining to the effects of lobotomy on intelligence and the ability to perform tasks
Keeping House/Working	Meaning units pertaining to a patient's ability to return to their role as a homemaker or pursue other occupational opportunities outside of the home
Lobotomy shortens hospital stay	
Increased Length of Stay	Meaning units pertaining to a lack of remission from symptoms that led to an increased length of hospitalization
Decreased Length of Stay	Meaning units pertaining to a remission or improvement in symptoms leading to a shortened course of hospitalization
Lobotomy has shortcomings	
Professional Scrutiny	Meaning units that demonstrated the scientific community's lack of endorsement and skepticism on lobotomy
Violence	Meaning units pertaining to ineffectiveness of reducing agitation
Schizophrenia and Psychotic Disorders	Meaning units pertaining to poor outcomes in these specified conditions

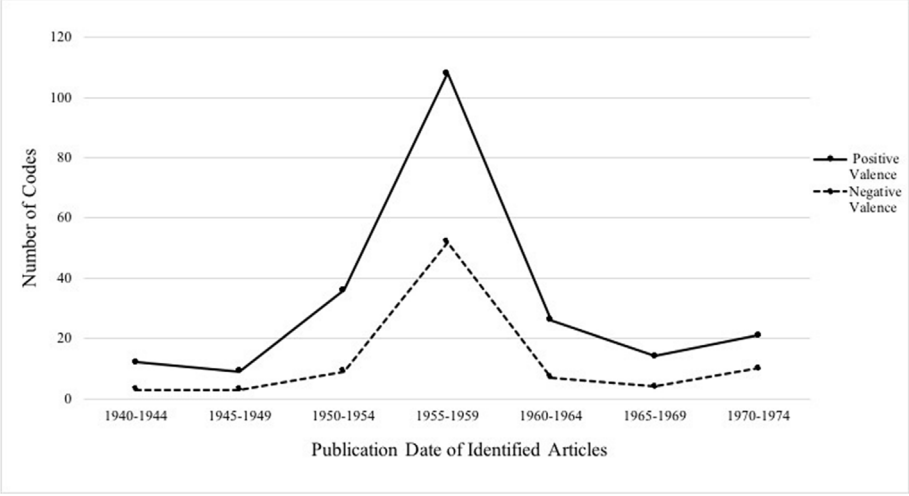

Fig. 3. Codes over time for all of the identified themes.

condensed meaning units such as mortality, both operative and post-operative, including suicide, as well as unwanted side-effects of the procedure such as 'frontal lobe syndrome' or new onset seizures. Timing of lobotomy was identified as a category and included condensed meaning units that recommended the ideal time period to perform a lobotomy based on the course of a psychiatric condition, duration of hospitalization, or a patient's age.

A positive valence was ascribed to codes which agreed with the theme that lobotomy was a safe and precise procedure. A negative valence was ascribed to codes which explicitly stated lobotomy was a dangerous procedure, with a prevalence of operative side-effects. The positive valence trajectory over time within this theme displayed an initial code count of 3 in 1945–1949, and showed a maximum code count of 11 in 1955–1959, with a minimum code count of 0 in 1965–1969. The negative valence trajectory over time within this theme displayed an initial code count of 0 in 1945–1949, and showed a maximum code count of 11 in 1955–1959, with a minimum code count of 0 in both 1960–1964 and 1965–1969 (Fig. 4).

3.2. Lobotomy improves emotional and psychiatric outcomes

The improvement of emotional and psychiatric outcomes after lobotomy was recognized as a common theme across the articles. This theme encompassed condensed meaning units and codes that pertained to the procedure's amelioration of psychiatric symptoms and emotional wellbeing. Relief of distress was identified as a category derived from condensed meaning units in this theme that referenced the reduction of human suffering and disturbed behavior in lobotomized patients. Reduction of violence was identified as a category derived from condensed meaning units that referenced the decreased level of violence and seclusion rates in patients who had been lobotomized. Improvement of psychiatric conditions was identified as a category derived from condensed meaning units that referenced the symptomatic and prognostic improvement of patients who had undergone lobotomy. Diagnoses associated with positive improvement was identified as a category derived from condensed meaning units that referenced specific diagnoses, like anxiety and obsessive tension states, which responded well

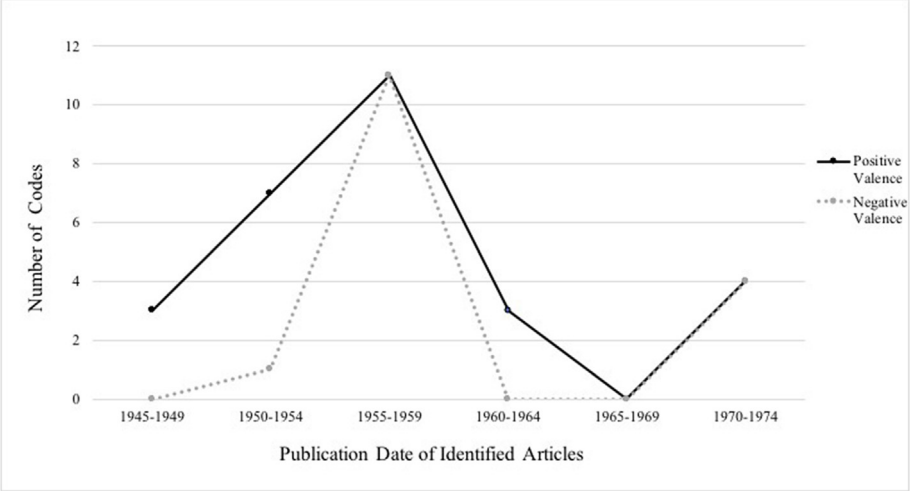

Fig. 4. Codes over time for the theme of lobotomy is a safe and precise procedure.

to lobotomy. Effects on personality was identified as a category derived from condensed meaning units that referenced the desirable changes in a patient's personality and maturity level after the procedure.

A positive valence was assigned to codes which agreed with the overall theme that lobotomy improves emotional and psychiatric outcomes and negative valences were assigned to codes which explicitly stated that lobotomy did not relieve distress, did not reduce violence, did not improve psychiatric symptoms or conditions, and did not have a desirable effect on a patient's personality. The positive valence trajectory over time displayed an initial code count of 6 in 1940–1944, and showed a maximum code count of 52 in 1955–1959 and a minimum code count of 5 in 1945–1949. The negative valence trajectory over time displayed a minimum code count of 1 in 1940–1944 and again from 1945–1949, whereas the maximum code count peaked in 1955–1959 with a unit count of 22. In total, there were 112 codes with positive valence values and 36 codes with negative valence values during the entire 1940–1974 timeframe (Fig. 5).

3.3. Lobotomy improves social functioning

The improvement of social functioning after lobotomy was recognized as a common theme within the articles reviewed. This theme encompassed condensed meaning units and codes that pertained to the procedure's positive impact on the social and occupational functioning of patients. Integration into society was identified as a category derived from the condensed meaning units in this theme that referenced a patient's ability to return home and their successful incorporation within the household and community after undergoing lobotomy. Intellectual functioning was identified as a category derived from condensed meaning units in this theme that referenced improved intelligence and task performance in patients who had undergone lobotomy. Keeping house/working was identified as a category derived from condensed meaning units in this theme that referenced a patient's ability after lobotomy to return to their role as a homemaker or pursue other occupational and educational opportunities outside of the household.

A positive valence was assigned to codes which agreed with the overall theme that lobotomy improves social functioning and a negative valence was assigned to codes which explicitly stated that lobotomy did not improve integration into the community, did not improve intelligence, and did not improve a patient's ability to go to work, school, or keep house. The positive valence trajectory over time displayed an initial code count of 6 in 1940–1944, and showed a maximum code count of 29 in 1955–1959 and a minimum code count of one in 1945–1949 and 1965–1969. The negative valence trajectory over time displayed a

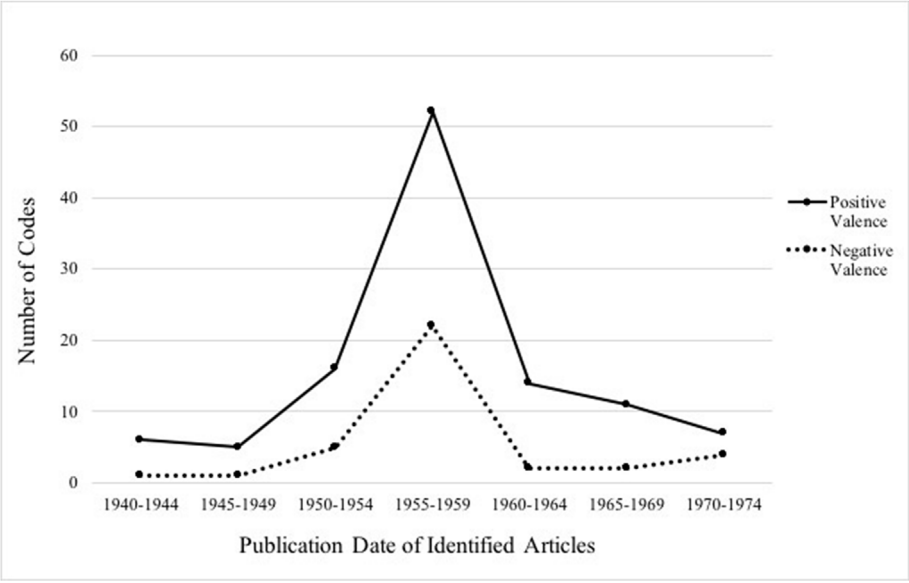

Fig. 5. Codes over time for the theme of lobotomy improves emotional and psychiatric outcomes.

minimum code count of 0 in 1945–1949 and again from 1950–1954, whereas the maximum code count peaked in 1955–1959 with a unit count of four. In total, there were 58 codes with positive valence values and 9 codes with negative valence values during the entire 1940–1974 timeframe (Fig. 6).

3.4. Lobotomy shortens hospital stay

Lobotomy shortens hospital stay was identified as a common theme within the articles reviewed. This theme encompassed condensed meaning units and codes that pertained to the reduction of inpatient admissions following the procedure as captured from both quantitative and qualitative statements made relating to hospital stays. Decreased length of hospital stay was identified as a category derived from the condensed meaning units in this theme that encompassed remission or improvement in symptoms leading to a shortened course of hospitalization. This included raw data of discharge rates or patients living at home after lobotomy as well as language that alluded to decreased length of stay such as "resumed employment" or synonymous descriptors indicating improvement after lobotomy such as "relief, stabilized, productive." Increased length of hospital stay was identified as a category derived from the condensed meaning units in this theme that referenced a lack of remission from symptoms that led to a lengthened hospital course. Codes specific to increased length of hospital stay included raw data that indicated failure of discharge from the hospital after lobotomy as well as language that implied increased length of hospital stay such as "not recovered."

A positive valence was assigned to codes that demonstrated lobotomy shortened the length of hospitalization, and negative valences were ascribed to codes that demonstrated lobotomy increased the length of hospitalization stay. The positive valence trajectory of the theme over time displayed an initial code count of 3 in 1950–1954, and showed a maximum code count of 16 in 1955–1959 with a subsequent minimum code count of 1 in 1970–1974. The negative valence trajectory of the theme over time displayed a minimum code count of 0 in both 1950–1954 and 1960–1974, whereas the maximum code count peaked in 1955–1959 with 2. In its entirety, the positive valence values of this theme totaled 26 while negative valence values totaled 2 during the entire 1950–1974 timeframe (Fig. 7).

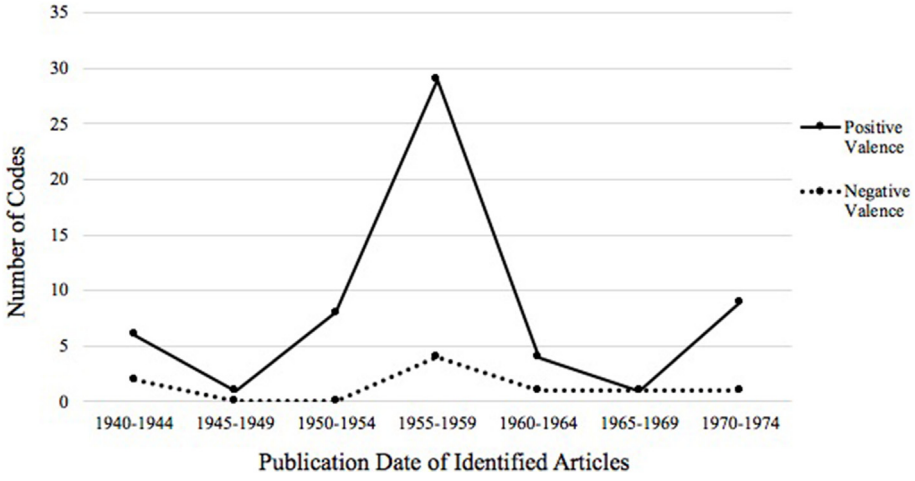

Fig. 6. Codes over time for the theme of lobotomy improves social functioning.

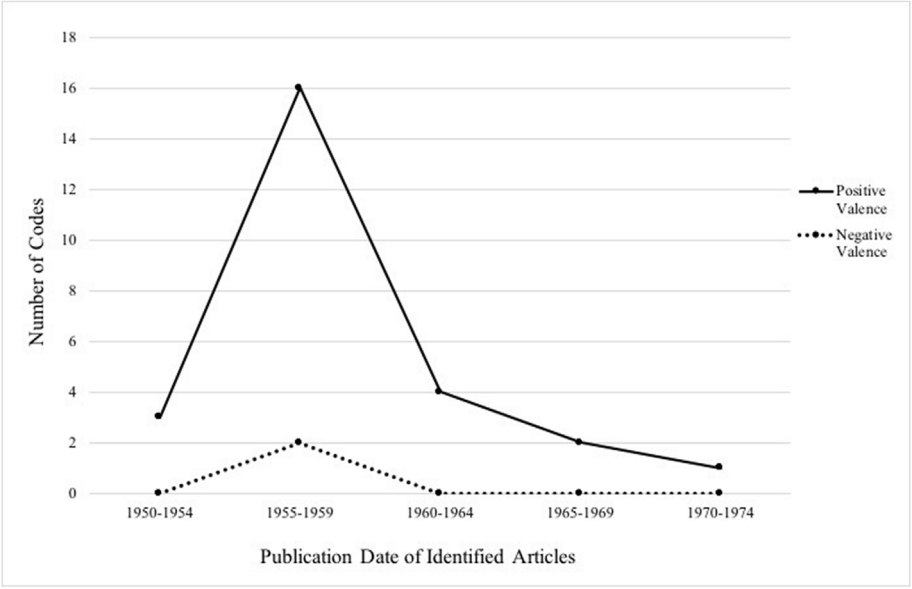

Fig. 7. Codes over time for the theme of lobotomy shortens hospital stay.

3.5. Lobotomy has shortcomings

One of the overarching themes identified within the sample of articles was lobotomy has shortcomings. This theme encompassed condensed meaning units and codes that pertained to the clinical failures of lobotomy. Professional scrutiny of the procedure was identified as a category derived from the condensed meaning units in this theme relating to the medical community's skepticism and condemnation of lobotomy, as well as their acknowledgement of the deficits and lack of conclusive evidence supporting the efficacy of the procedure. Schizophrenia and psychotic disorders was established as a category derived from condensed meaning units that highlighted the poor outcomes of the procedure in individuals with these conditions; this included the persistence of their psychiatric symptoms. Violence was established as a category derived from condensed meaning units that referenced increased agitation, increased inpatient seclusion, inability to control rage and homicidal behavior in patients who had undergone the operation.

A positive valence was ascribed to codes in disagreement with the theme of lobotomy's shortcomings, essentially signifying that lobotomy was an effective procedure. Negative valences were ascribed to codes that demonstrated lobotomy's lack of clinical efficacy. The positive valence trajectory over time within this theme displayed an initial code count of 0 in 1945–1949, and showed a maximum code count of 2 in 1950–1954, with a minimum code count of 0 in 1945–1949, 1955–1959, 1965–1969, and 1970–1974. The negative valence trajectory over time within this theme displayed an initial code count of 2 in 1945–1949, and showed a maximum code count of 13 in 1955–1959, with a minimum code count of 1 in both 1965–1969 and 1970–1974 (Fig. 8).

Lastly, in order to offset the potential influence of the uneven number of articles in each timeframe, we calculated the total number of positive valences in relation to the number of articles analyzed from each decade. This was done in order to make the different time periods more comparable (Table 3).

Table 3
Number of positive valences per article in each decade.

Publication Years	Number of Positive Valences	Number of Articles	Number of Positive Valences/Number of Articles
1940–1949	23	3	7.67
1950–1959	142	9	15.78
1960–1969	38	3	12.67
1970–1979	23	1	23

4. Discussion

In this study we set out to examine whether Walter Freeman and James Watts' characterizations of lobotomy in the scientific literature was biased by both the prevailing scientific, social, and economic conventions of their era and their impulse to exaggerate the benefits of a procedure they had pioneered in the United States. This involved investigating whether the authors employed excessively positive characterizations of lobotomy's therapeutic efficacy and social benefit, even in the face of significant opposition from the medical community, and whether the language used to promote the procedure changed to better appeal to the evolving social and scientific conventions. What this study reveals is the overwhelmingly positive depiction of lobotomy in the works of Freeman and Watts as conveyed by the significantly higher number of codes with positive valences across the span of time examined. This was likely due to a pro-innovation bias which, according to Everett Rogers, is a belief that an innovation should be adopted by society without the need for any changes (Rogers, 1995). Pro-innovation bias can lead innovators to not recognize any shortcomings or weaknesses in their work. While these results could have also been influenced by the uneven number of articles referenced in each of the timeframes, the results of this study show this trend persisting as late as 1970–1974, over a decade after the U.S. medical establishment unanimously rejected the procedure in favor of emerging pharmacotherapeutic agents. Moreover, the smaller code count early on (1940–1944) was likely shaped by the fact that Freeman and Watts were speaking to an already converted audience that were open to lobotomy's efficacy and would go on to award Egas Moniz the Nobel Prize five years later for pioneering the procedure.

Freeman and Watts's earlier works (1945–1949) almost unanimously described prefrontal lobotomy as a safe and anatomically precise procedure despite the obvious invasiveness of the operation and the absence of stereotactic guidance. Prefrontal lobotomy required drilling burr holes into the skull of patients and the near-blind insertion of a sharp surgical instrument through them to destroy cerebral tissue, making it a crude procedure that lacked in precision, even by the standards of the period (Diefenbach et al., 1999). In 1954 Freeman claimed "the great majority of transorbital operations have been done by psychiatrists. The mortality and morbidity experience of these operators has been gratifyingly and consistently low" and he continued to assert this by writing in 1958 that "refinements in the matter of extent and in avoiding trauma to the cortex with its consequent danger of convulsive seizures, have made lobotomy a relatively safe operation" suggesting the procedure had minimal risk of adverse outcome. Yet, in 1949, *The New England Journal of Medicine* published on what later would be coined 'post leucotomy syndrome:' "these patients are not only no longer distressed by their mental conflicts but also seem to have little capacity for any emotional experiences – pleasurable or otherwise. They are described by the nurses and the doctors, over and over, as dull, apathetic, listless, without drive or

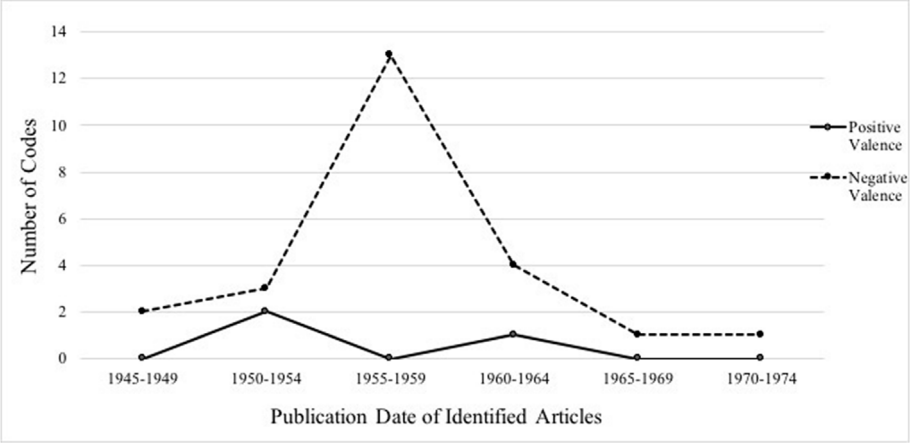

Fig. 8. Codes over time for the theme of lobotomy has shortcomings.

initiative, flat, lethargic, placid and unconcerned, childlike, docile, needing pushing, passive, lacking in spontaneity, without aim or purpose, preoccupied and dependent" (Hoffman, 1949). Freeman and Watts's motivation to promote this new and seemingly crude surgical innovation to their professional audience explains the significantly greater delta between the much larger positive valences associated with the safety and precision of the surgical technique as compared to the negative valences in the first decade of their publications. There is no indication that the more "refined" transorbital approach to lobotomy, introduced by the authors in 1946, improved either precision or safety as they tried to convey in their articles. The procedure, which remained invasive, was described as "a little more than a shot in the dark" in a 1949 issue of *Psychiatric Quarterly* and continued to be criticised in other professional forums. Well respected leaders of the medical community spoke out against lobotomy; Nolan Lewis, a psychiatrist at Columbia University and director of the New York State Psychiatric Institute in 1949 stated the following, "Is the quieting of the patient a cure? Perhaps all it accomplishes is to make things more convenient for the people who have to nurse them … I would guess that lobotomies going on all over the world have caused more mental invalids than they've cured … I think it should be stopped before we dement too large a section of the population" (Lewis, 1949). This was corroborated by a U.S. Army neurosurgeon in 1948 who decried the dearth of published data on the negative outcomes of lobotomy (Philips, 2013). The rising prestige of the procedure in the international scientific community, culminating in the 1949 Nobel Prize being awarded to Egas Moniz, the founder of lobotomy, further enabled the authors to escape scrutiny and allowed them to continue to promote lobotomy as a precise and safe procedure unperturbed by the growing chorus of professional detractors at the time (Johnson, 2014). This can be seen in the significantly greater delta between the much larger positive valences as compared to the negative valences in 1960.

The articles published in the latter half of the 1950s increasingly promoted lobotomy's beneficial impact on the social, emotional, and psychiatric states of patients and shortening hospital stay. Both themes show almost identical graphical patterns, with positive valences reaching their peak and greatest delta against negative valences between 1955 and 1959. The impulse of the authors to present lobotomy as a solution to the overcrowding in state mental hospitals and asylums, whose populations had quadrupled in the first half of the twentieth century, likely drove this phenomenon (Bassuk and Gerson, 1978). As the rate of hospitalizations went up, so did the costs of maintaining state mental health facilities, creating a financial incentive state mental health program directors to accept a dramatically invasive procedure like lobotomy that purported to reduce psychiatric hospitalization. According to March and Geloso (2020), the financially pressured public hospitals and asylums turned to lobotomy as an economically favorable treatment to decrease their growing patient population despite the widespread agreement within the general medical community that the procedure was ineffective. Despite this, Freeman wrote "it seems not only possible, but obligatory, to extend the program of psychosurgery into the state mental hospitals in an effort to relieve human misery" projecting a sense of heroism in his endorsement of lobotomy amidst realities of financial incentives (Freeman, 1954). Freeman, who was commissioned in 1952 by the West Virginia State Hospital Board to assist with managing their burgeoning patient population, understood the appeal of promoting lobotomy in these overburdened facilities as a procedure that could relieve distress, improve psychiatric symptoms, and help their patients return to a productive life outside of the hospital.

According to Freeman and Watts's conception of mental illness, emotional dysregulation was a major component of the psychopathological process (Johnson, 2014). The over and under expression of emotions, particularly emotionality, is often evaluated through a social and cultural lens by both individuals and society. In one of their 1944 publications, the authors state "prefrontal lobotomy relieves nervous tension and often aids the individual in achieving the end he pursues" suggesting that American idealism and opportunity could be accomplished through the procedure itself (Watts and Freeman, 1944). This placed specific demographic groups who were more often emotionally mislabeled, particularly women, at a disproportionate risk of undergoing lobotomy. Although the majority of patients in psychiatric facilities were men in the early 1950s, a national study found that nearly 60% of lobotomies had been performed on women (Kramer et al., 1954). Gender also affected the determination of successful outcomes by Freeman and Watts which they highlighted through the post-surgical social adjustment of their patients. These standards of social adjustment were derived from the ability of patients to perform their expected gender roles, which explains the disproportionate rate of "successful" lobotomies among women who were then able to return to their vaguely defined role of "keeping house" in the case reports of Freeman and Watts. Lobotomy empowered the social and political elite to enforce conformity and subdue dissent in the patriarchal post-Second World War era in America, and the "docile" nature of lobotomized patients, particularly emotive women, provided an incentive to continue the practice despite the evidence against it (Johnson, 2014).

Across the span of the articles covered in this study, the authors often dismissed or managed to misattribute the critiques brought on by their professional detractors. In line with this, lobotomy's shortcomings is the only theme in this study where the negative valences consistently occur more often than positive valences. This was particularly notable in the authors' efforts to downplay professional scrutiny of the procedure. John Fulton, a notable American physiologist and pioneer of lobotomy, declared the end of lobotomy as he ushered in a new age of stereotactic neurosurgery in 1952. Lobotomy's appeal was further eroded in the professional community with the revolutionary introduction of a successful non-invasive pharmacological treatment for severe psychiatric illnesses in the form of chlorpromazine in 1955 (Faria, 2013). Freeman fails to address such critiques stating "Poor results of lobotomy are traceable to two main factors, poor material and poor surgical technique. Less often responsible for failure are uncooperative families and associated physical diseases such as tuberculosis or cancer" (Freeman, 1958). This may explain why negative valences associated with lobotomy's shortcomings peaked in 1955–1959 as the authors sought to counter the rising tide of detractors against the procedure. Yet, the efforts of the authors to oppose critics abruptly falls off by 1970–1974, likely in the face of a tidal wave of social opposition to lobotomy as portrayed in popular literary works and media productions such as Sylvia Plath's bestselling *The Bell Jar* and the Oscar-winning film adaptation of Ken Kesey's *One Flew Over The Cuckoo's Nest.* This does not take away from the remarkably obstinate decades-long promotion of the procedure by Freeman and Watts through the rejection of criticisms and scrutiny of lobotomy that began with the American Medical Association's denunciation in 1941 (Valenstein, 1986).

5. Limitations

Due to the nature of our methodology, there are some limitations to our study. This study did not qualitatively characterize meaning units by assigning magnitudes of strength to individual positive and negative valences. Meaning units with neutral valences were excluded from this study, which limited a richer scope of analysis. Purely qualitative articles that did not include quantitative data and other literature such as textbooks were not captured in our study. Additionally, we were unable to include articles that were not available in full text digital formats in the databases we examined. This contributed to a smaller sample size which likely affected the scope and results of this study. This contributed to only two articles co-authored by Watts to be examined in this study, limiting our ability to fully ascertain Watt's contribution to the positive depiction of lobotomy over time. It also led to an uneven number of articles examined within each time frame, affecting the overall trend of positive and negative valences in this study, which likely affected data trends in

this study. We acknowledge that if an article was written with the expressed intent of strongly defending against detractors of lobotomy, the number of positive references might be skewed relative to other articles. While we could not assess any overt intent in any of the articles, we acknowledge that this could certainly affect the direction of our data.

6. Conclusion

The purpose of this study was to analyze the role of bias in the depictions of lobotomy in the pioneering medical articles of Walter J. Freeman and James W. Watts. Our results show that Freeman and Watts's characterizations of the procedure were overwhelmingly positive and the positive outcomes of lobotomy that they reported followed prevailing emotional, social, and economic norms of their era. Their positive portrayal of lobotomy, even in the face of professional evidence to the contrary, points to the authors' confirmation bias and an unwillingness to deviate from their preconceptions, beliefs, and preferences when it came to evaluating psychiatric illness, recovery, and the complication of the procedure they were pioneering. Their reported positive results may have followed social norms, raising concern to the prevalence of social desirability bias in the way the investigators reported their outcomes; one in which socially undesirable emotions and behaviors were seemingly underreported in favor of more desirable attributes in patients that had undergone lobotomy. Then, as in today, intellectual and financial conflict of interests can consciously or unconsciously make researchers vulnerable to biases that can increase their funding, prestige, and position. This study not only reveals the role of these biases in popularizing one of the last century's most controversial medical procedures, it also introduces new analytical frameworks to evaluate scientific narratives and teach the role of bias in biomedical research.

Future directions

Institutional review boards are more likely to grant researchers access to the medical records of Walter J. Freeman and James W. Watts as the interval of time from their last performed lobotomy increases. A statistical meta-analysis of these records, particularly the demographic and outcome data of patients, can shed better light on the discrepancies between what Freeman and Watts conveyed in their writings and the actual data on the procedure.

Declaration of interest statement

None.

Ethical approval

This article does not contain any studies with human participants or animals performed by any of the authors.

CRediT authorship contribution statement

Amir A. Afkhami: Conceptualization, Methodology, Formal analysis, Investigation, Supervision, Writing – review & editing. **Javad John Fatollahi:** Validation, Formal analysis, Investigation, Visualization, Writing – original draft. **Melissa A. Peace:** Validation, Formal analysis, Investigation, Visualization, Writing – original draft. **Ramsin J. Yadgar:** Validation, Formal analysis, Investigation, Visualization, Writing – original draft. The authors also acknowledge John Clark for his early conceptual contribution

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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