

Research Article

# What Can We Learn From the Past About the Future of Gerontology: Using Natural Language Processing to Examine the Field of Gerontology

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## Abstract

**Objectives:** We thematically classified all titles of eight top psychological and social gerontology journals over a period of six decades, between 1961 and February 2020. This was done in order to provide a broad overview of the main topics that interest the scientific community over time and place.

**Method:** We used natural language processing in order to analyze the data. In order to capture the diverse thematic clusters covered by the journals, a cluster analysis, based on “topic detection” was conducted.

**Results:** A total of 15,566 titles were classified into 38 thematic clusters. These clusters were then compared over time and geographic location. The majority of titles fell into a relatively small number of thematic clusters and a large number of thematic clusters were hardly addressed. The most frequently addressed thematic clusters were (a) Cognitive functioning, (b) Long-term care and formal care, (c) Emotional and personality functioning, (d) health, and (e) Family and informal care. The least frequently addressed thematic clusters were (a) Volunteering, (b) Sleep, (c) Addictions, (d) Suicide, and (e) Nutrition. There was limited variability over time and place with regard to the most frequently addressed themes.

**Discussion:** Despite our focus on journals that specifically address psychological and social aspects of gerontology, the biomedicalization of the field is evident. The somewhat limited variability of themes over time and place is disconcerting as it potentially attests to slow progress and limited attention to contextual/societal variations.

**Keywords:** Gerontology, Natural language processing, Research, Science, Thematic analysis

The present study thematically classified the titles of top psychological and social gerontology journals over a period of six decades, between 1961 and April 2019. This was done in order to provide a broad overview of the main topics that interest the scientific community over time and in different geographic locations. As such, this study points to general scientific trends as well as to underexplored areas that may need additional research attention.

The term gerontology was coined by Ilya Ilyich Metchnikoff, a Russian Zoologist, in 1903. The term is based

on the Greek terms “geron,” “old man,” and “logia,” “the study of.” The term has since been defined as “the comprehensive multidisciplinary study of aging and older adults.” The multidisciplinary field of gerontology consists of three main disciplines: biology, sociology, and psychology. Other disciplines such as nursing, social work, law, public health, economics, and geography are also included within this broader category of gerontology (Bass & Ferraro, 2000).

Given its multidisciplinary nature, the field of gerontology has been primarily concerned with its

professional boundaries and characteristics (Ansello, 2011; Ferraro, 2006). There has been a debate between those who believe that the field of gerontology should not or does not serve as a discipline on its own, but should rather be an addendum to already existing and established disciplines, such as psychology or sociology, for instance, versus those who advocate for viewing the field of gerontology as a discipline in its own right. Consistently, whereas some have viewed gerontology as a multidisciplinary field composed of researchers from distinct disciplines, that are engaged with their own research methods and questions to study aging, aged and/or old age, others have advocated for gerontology as an interdisciplinary field, in which the different disciplines collaborate and eventually merge to produce research methods and questions, which go beyond their original disciplinary boundaries to reflect a unique discipline, named gerontology (Alkema & Alley, 2006; Ansello, 2011; Ferraro, 2006). These debates are not surprising given the fact that the field of gerontology is relatively new, with the first doctoral degree program in gerontology being conferred in 1993. Moreover, only in 2005 did the Gerontological Society of America formally recognize gerontology as a stand-alone discipline (Alkema & Alley, 2006).

A main criticism concerning the field of gerontology has been its atheoretical nature, and its failure to develop clear and agreed-upon conceptual and methodological contributions and guidelines (Bass, 2013). Related to this concern is the substantial reliance of the field on a positivistic approach, which often is based on large survey and population studies in the absence of theoretical guidelines. This has led some to describe gerontology as rich in data, but poor in theory (Birren & Bengtson, 1988). A strength of the field of gerontology, though, concerns its established practical and policy agenda and ties (Samanta, 2017).

Supposedly, the field of gerontology was established in order to deal with the “problem” of aging, and as such, the biomedical approach has gained a substantial influence, whereas psychosocial aspects of aging have received less attention (Achenbaum, 1987; Estes & Binney, 1989). In the light of the emphasis put forth by the biomedical approach, it is particularly important to examine the role of the other two arms on which the field of gerontology was established, namely, the psychological and social arms. As gerontology is distinguished from geriatrics, for example, the study of the health and care of older adults, it is important to examine the psychological and social issues addressed by the field of gerontology in order to assess its unique contribution. An examination and classification of the main topics addressed by the top gerontology journals, with a psychological and/or social focus, allows us to understand where the field has been and the trajectories it has taken over time.

## The Important Role Played by Research in Shaping Public Attitudes and Behaviors

The way research portrays old age and older adults makes a difference. For instance, a study on the social construction of Alzheimer’s disease (AD) has pointed out its depiction as a leading cause of death. Supposedly, this has been crucial for obtaining funding and gaining visibility but has failed to support the caregivers of people who are diagnosed with dementia and their psychosocial needs (Chaufan, Hollister, Nazareno, & Fox, 2012). Other scientific topics also have been examined in-depth to understand their portrayal and context in the field of gerontology. For instance, researchers have pointed out the scarcity of research attention given to the topic of sexuality and the representation of older adults’ sexuality in the scientific literature as non-trivial and even surprising (Scherrer, 2009). A different comprehensive analysis of the scientific literature has stressed the two poles along which older people are portrayed as either successful agers or not (e.g., “failures”) (Chen, Kim, Moon, & Merriam, 2008).

These various portrayals of old age and aging in the scientific literature likely correspond with everyday representations of older adults in advertisements and the media (Lee, Carpenter, & Meyers, 2007). Moreover, the scientific description of older adults may correspond with the views that the general public holds about older adults and the views that older adults hold about themselves (Radford, 1987; Reynolds, 1997). Although many possible explanations account for attitudes towards older people and towards aging, the role of the scientific literature in establishing and promoting ageist attitudes cannot be overlooked. The scientific literature likely also shapes policies and legislations (Hinshaw & Grady, 2010). If biological issues receive prominence over psychosocial issues associated with aging, it is likely that biological interventions and policies will be promoted and psychosocial issues will be neglected.

## The Present Study

Classifying the contents addressed by the top gerontology journals with a focus on psychological and social aspects is important because these journals are responsible for shaping the field of gerontology. The main topics presented by scientific gerontology journals represent a well-defined body of evidence concerning the representations of old age and aging. Researchers, students, and practitioners have been using the information published in scientific journals to generate additional knowledge, as well as to produce curricula, policies, legislations, and interventions among other things (Blackburn & Dulmus, 2007; Olson, 1996). A thematic analysis of the leading scientific journals in the field of gerontology will point to the main messages and contents that are at the heart of the scientific consensus. This research may also identify those topics that are

currently lacking scientific attention. Possibly, if biological issues are discussed within the psychosocial journals in the field of gerontology, this might reflect the multidisciplinary nature of the field. However, if biological issues gain prominence in psychosocial journals, then there is a risk that important psychosocial issues would become meddled and completely ignored.

Using natural language processing, we examined the scientific literature in eight leading journals in the field of gerontology, which have an explicit stated focus on psychological and/or social aspects. In our review, we classified the main contents addressed by the journals, overall and separately by year of publication and geographic location. We expected that the biomedical approach to aging would be dominant even in journals that self-identify as psychological or social in nature. We also expected some variability over time, given the fact that the field of gerontology is still emerging. We had no clear hypotheses concerning variations over geographic location. However, even though topics such as impaired activities of daily living might be relevant worldwide, their impact and manifestations likely vary across different countries (Guido, Morandi, Palluzzi, & Borroni, 2015; Hajek & König, 2016). Moreover, other topics such as successful aging may be more relevant in western cultures compared with more Eastern cultures (Lamb, 2017). As the entire field of cross-cultural gerontology is built on the premise that different societies have their own unique cultural characteristics that influence individual and population aging (Chi, 2011), we expected to find variations across different geographic regions.

Several prominent researchers have critically examined the history of the fields of gerontology and geriatrics (Cole & Holstein, 1994; Morley, 2004; Shock, 1951). Although extremely valuable, this work provides an in-depth understanding of selected topics rather than a systematic broad overview of a large and representative corpus of knowledge. Others have examined the contents of gerontology journals using means, such as bibliometric network methods, for instance, the majority of this research has focused on a single topic, such as AD (Ansari, Gul, & Yaseen, 2006), frontotemporal dementia (Guido et al., 2015), assistive technology (Asgar, Cang, & Yu, 2017), stroke (Asplund, Eriksson, & Persson, 2012), physical activity and aging (Guido et al., 2015), cardiovascular disease (Ugolini et al., 2013), or successful aging (Kusumastuti et al., 2016). However, to the best of our knowledge, only two papers have examined the entire scientific field of gerontology, using bibliometric methods. One study examined the fields of gerontology and geriatrics, focusing on the number of journals and their impact factor (Ang & Kwan, 2017). The other paper identified the most cited papers, the main research groups and the main keywords used in the field (Shen, Nguyen, & Hsu, 2019). As such, the present study provides an innovative and a much needed critical perspective on the scientific literature in the field of gerontology.

## Method

We included all titles of eight journals with an explicit psychological and/or social focus (a) *The Gerontologist* (1961–2020), (b) *Research on Aging* (1979–2020), (c) *Psychology and Aging* (1986–2020), (d) *Journal of Gerontology B: Social Sciences* (1995–2020), (e) *Journal of Gerontology B: Psychological Sciences* (1995–2020), (f) *Ageing and Society* (1989–2018), (g) *Journal of Applied Gerontology* (1982–2019), and (h) *Aging and Mental Health* (1984–2020). These journals were selected because they were written in English, had an explicitly stated focus on psychological and/or social areas in the field of gerontology, rather than on biological or medical aspects and had an impact factor greater than 1. Journal titles were retrieved via PubMed or ProQuest. We included all available article titles available by February 2020. We excluded conference abstracts, commentaries, and book reviews.

We relied on natural language processing (Goldberg, 2016) to analyze the data. In order to capture the diverse thematic clusters covered by the journals, a cluster analysis, based on “topic detection” was conducted (Wartena & Brussee, 2008). This represents a task of data discovery without any prior knowledge of topic context/s or possible topics (Wartena & Brussee, 2008). Each topic can be expressed with different words and phrases, and each phrase or word holds syntactic and semantic information, which depends on its context (Liu, Liu, Chua, & Sun, 2015). In the current study, the topic detection task consisted of three stages (a) data preparation, (b) running the clustering algorithm, and (c) identifying the right clustering parameters.

In the *data preparation stage*, we tried to capture the word’s context by using a method called “word embedding” (Liu et al., 2015). This is a technique that assigns a high dimensional vector to each word by using a neural network model (Mikolov, Chen, Corrado, & Dean, 2013). Placing words along a vector space can help to measure distances and calculate angles between different words. In order to first learn word-embedding, we downloaded 11,003 articles, representing diverse social science topics and ran Word2Vec algorithm (Mikolov et al., 2013). We computed the model at the single word level (unigram), and at the phrase level (n-gram). The outcome of the model is a long list of vectors for each word and for each phrase that has been found in the social science articles. Thus, we can query the model and ask for the most similar meaning of words or phrases. For example, when we queried the algorithm regarding the word “ageism,” we received the following options: “ageism’s,” “ageist,” “racism,” “prejudice,” and “discriminatory.” We can also measure the semantic distance between these words.

Next, we downloaded 16,386 titles from the eight journals mentioned above. After excluding comments, abstracts, and book reviews, we applied the word2vec model vectors (Mikolov et al., 2013). Each word or high frequent phrase is replaced by a numeric vector. Each vector consists of 100 numbers (dimensions).

In the second stage, we ran a *K-means clustering algorithm* (MacQueen, 1967). The K-means algorithm is a popular data-clustering algorithm. However, one of its drawbacks is the requirement for the number of clusters, *K*, to be specified before the algorithm is applied (Pham, Dimov, & Nguyen, 2005). As we did not want to predetermine the number of clusters, we ran the algorithm multiple times for a range of *K* values.

In the last stage, we used silhouette analysis (Kodinariya & Makwana, 2013). Using this technique, clustering can be characterized by the silhouette value, which ranges from -1 to 1. If the silhouette values are close to 1, it means that the set is well clustered (Kodinariya & Makwana, 2013). Once we reached the number of clusters with the best silhouette value, we extracted the cluster centers in the vector space and assigned them all words and phrases with minimal Euclidian distances. This explained the topics of each cluster. We allowed for each topic to appear in more than one cluster. At this stage, the three researchers manually reviewed the clusters, united clusters with similar meaning, and deleted clusters, of undefined or non-unique topic/s. Our final analysis resulted in 38 clusters, used to classify 15,566 titles.

After creating the clusters, descriptive statistics were obtained using Excel, in order to explore the representations of the different clusters overall and by year of publication and geographic location. The representation of the different thematic clusters over time was examined by dividing the clusters to different decades between 1961 and 2019. The representation of the different clusters across geographic regions, was examined using the World Health Organization (WHO) definition of regional groupings (World Health Organization, 2019).

## Results

Supplementary Table 1 presents all 38 thematic clusters identified. The table provides an account of each thematic cluster, keywords used to derive this cluster and selected references for illustrative purposes. Figure 1 presents the 38 thematic clusters by frequency of appearance. As can be seen, the curve results in a right-skewed distribution, in which very few thematic clusters receive the majority of

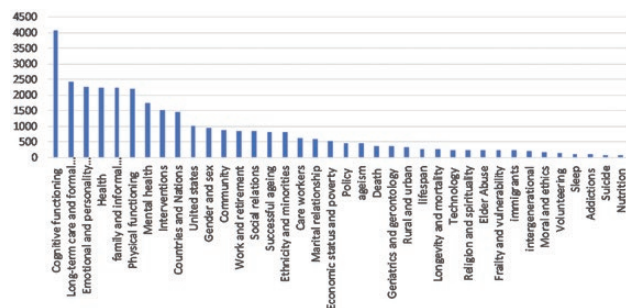


Figure 1. Thematic clusters by frequency of appearance.

scientific attention and a large number of thematic clusters receive only minimal scientific attention.

The most frequently addressed thematic clusters are (a) Cognitive functioning, which represents 12.47% of the titles. This cluster addresses mainly topics concerning dementia, AD, cognitive decline, and cognitive functioning; (b) Long-term care and formal care, represents 7.4% of the titles. This cluster consists of topics such as hospital care, formal care, home care, and nursing homes; (c) Emotional and personality functioning represent 6.93% of the titles. This cluster consists of the following key terms: well-being, emotional functioning, coping mechanisms, and locus of control. (d) Health represents 6.9% of the titles. Here, the most common topics concern a variety of medical conditions and chronic illnesses; (e) Family and informal care represents 6.86% of the titles. This cluster covers mainly family care and informal (unpaid) care.

The least frequently addressed thematic clusters are (a) Volunteering, addressed by 0.44% of the titles. This thematic cluster consists of issues concerning the effects and the motivations for volunteering among older adults; (b) Sleep, addressed by 0.33% of the titles. This concerns topics such as sleep habits, insomnia, and fatigue; (c) Addictions, addressed by 0.31% of the titles, covering topics such as alcohol and drug addiction; (d) Suicide, represented by 0.28% of the titles, addressing suicide ideation and acts; and (e) Nutrition, addressed by 0.21% of the titles. This thematic cluster consists of keywords, such as nutrition, appetite, feeding, and diet.

As for changes in thematic clusters over time, the five most common thematic clusters between the years 1961–1970 (1.15% of the entire pool of articles reviewed) were (a) Long-term care and formal care (14.97% of the articles between 1961 and 1970), (b) Geriatric and gerontology research and education (12.03%; e.g., gerontology research, geriatric curriculum), (c) Interventions (8.56%; e.g., treatments, programs, interventions), (d) Health (7.22%), and (e) Mental health (7.22%; e.g., depression, anxiety). Between the years 1971–1980 (3.26% of the entire pool of articles reviewed), the five most common thematic clusters were (a) Long-term and formal care (14.8% of the articles between 1971 and 1980), (b) Interventions (8.29%), (c) Geriatric and gerontology research and education (5.84%), (d) Health (5.18%), and (e) Community (4.9%; neighborhood, community-dwelling). Between the years 1981–1990 (8.46% of the entire pool of articles reviewed), the five most common thematic clusters were (a) Long-term care and formal care (11.86% of the articles between 1981 and 1990), (b) Family and informal care (8.56%), (c) Cognitive functioning (8.52%), (d) Health (5.98%; functional ability, disability, activities), and (e) Interventions (5.77%). Between the years 1991–2000 (13.82% of the entire pool of articles reviewed), the five most common thematic clusters were (a) Cognitive



functioning (14.03% of the articles between 1991 and 2000), (b) Long-term care and formal care (8.35%), (c) Family and informal care (8.3%), (d) Physical functioning (7.75), and (e) Health (7.15%). Between the years 2001–2010 (27.88% of the entire pool of articles reviewed), the five most common thematic clusters were (a) Cognitive functioning (13.36%), b) Long-term care and formal care (7.22%), (c) Emotional and personality functioning (7.2%), (d) Physical functioning (7%), and (e) Health (6.88%). Between the years 2011–2020 (45.44% of the entire pool of articles reviewed), the five most common thematic clusters were (a) Cognitive functioning (13.21% of the articles between 2011 and 2020), (b) Emotional and personality functioning (7.37%), (c) Health (7.12%), (d) Physical functioning (7.07%), and (e) Family and informal care (6.51%). See Figure 2 for details.

Next, we examined the distribution of the main thematic clusters according to the WHO regional groupings. Three locations had a large enough pool of articles for further discussion: Region of the Americas, the European region, and the Western Pacific region. The largest number of articles was published by first authors from the *Americas* (54.26%). The five thematic clusters most frequently addressed in these articles were (a) Cognitive functioning (13.28%), (b) Health (7.85%), (c) Physical functioning (7.51%), (d) Family and informal care (7.2%), and (e) Long-term care and formal care (7.11%). In *Europe* (19.61% of the articles reviewed), the five most addressed thematic clusters were (a) Cognitive functioning (16.84%), (b) Emotional and personality functioning (8.45%), (c) Countries and nations (8.03%; e.g., United Kingdom, Germany), (d) Physical functioning (6.99%), and (e) Family and informal care (6.02%). Finally, for the *Western Pacific* (7.63% of the articles reviewed), the five most common thematic clusters were (a) Countries and nations (15%; e.g., Australia, Japan), (b) Cognitive functioning (11.22%), (c) Mental health (8.16%), (d) Emotional and personality functioning (7.56%), and (e) Physical functioning (6.47%). Figure 3 presents the distribution of thematic clusters by geographic origin.

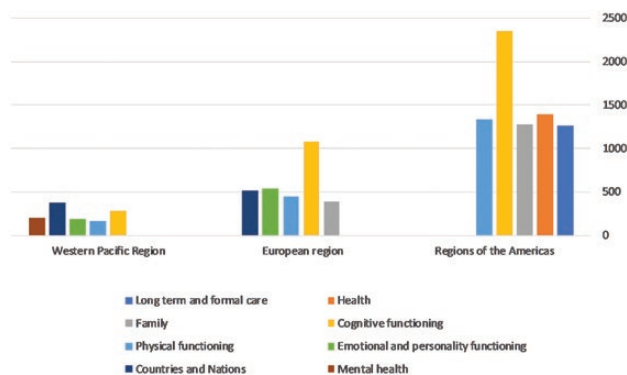


Figure 2. Main thematic clusters addressed over time.

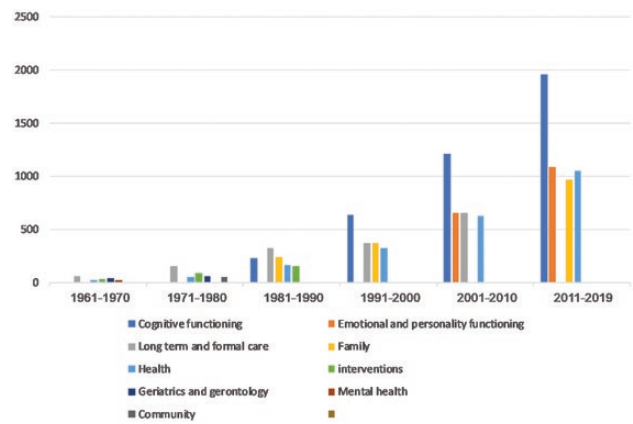


Figure 3. Main thematic clusters by geographic origin.

## Discussion

The present study evaluated the main thematic clusters addressed by gerontology journals with a clear psychological and/or social focus. This analysis is important given the role played by these journals in shaping the field of gerontology. Several notable findings emerged from the data. Of interest is the tendency to focus on biomedical topics at the relative neglect of psychosocial topics, as can be seen by the five most covered and least covered topics, respectively. Other interesting findings concern the relatively limited variations over time and space, as identified in this study.

The most common thematic clusters identified cover the following topics: Cognitive functioning, long-term care and formal care, emotional and personality functioning, health, family, and informal care. Two of these topics (e.g., cognitive functioning and health) have an explicit biomedical connotation. Moreover, the main keywords selected to represent these thematic clusters all address a deficit. Hence, this corresponds to the idea of the field of gerontology as being positioned to address the “problem of aging.” This further stresses the biomedicalization of aging and old age in the scientific literature (Estes & Binney, 1989). Of the top five most addressed thematic topics, the thematic cluster of emotional and personality functioning was the only one of direct explicit ties to psychological and social aspects of gerontology. Moreover, in contrast to the other clusters, its emphasis appears to be more positive in nature. The two additional prominent clusters addressed the issue of care provided to older adults either by family members and friends or through paid long-term care arrangements.

Cognitive functioning was covered by over 12% of all research titles (almost twice as many titles as the next in line). This cluster covered topics such as dementia, AD, and cognitive decline. Indeed, AD, the most common type of dementia, is considered to be a condition associated with old age, as the risk for developing AD increases dramatically in frequency after the age of 65 (Hebert, Scherr, Bienias, Bennett, & Evans, 2003). Currently, AD is the sixth leading cause of death in the United States (Murphy, Xu, Kochanek, & Arias, 2018). Despite the fact that the U.S. government,

along with other governments, has articulated a 2025 goal of prevention and treatment of AD, to date, there is no effective cure for the condition, and current means of prevention or delay of the progressive nature of AD are largely ineffective (Tricco et al., 2018). As such, this condition has been described as a tsunami (Sarkar, Irwin, Singh, Riccetti, & Singh, 2016), and there are many negative connotations, fears, and stigma attached to it (Avari & Meyers, 2018; Herrmann et al., 2018). The strong interest of the scientific community in cognitive functioning in general and dementia, in particular, might be fueled by the fears associated with these deteriorated states and the current lack of available treatments to prevent or delay deterioration.

Health also was a common thematic cluster addressed by the titles reviewed. It is important to note that the cluster named health addresses health deficits and illnesses as it concerns chronic medical conditions and ill health. Hence, similar to the cognitive functioning cluster, this cluster also concerns impairment and decline associated with old age. Moreover, similar to the cluster named, cognitive functioning, it addresses biomedical conditions, which likely are covered extensively in the geriatric literature (Roller-Wirnsberger et al., 2018). The emphasis of these topics over more psychosocial issues associated with aging could stem from the fact that these topics are seen as higher in the disciplinary hierarchy of science (Simonton, 2004).

Long-term care and formal care, as well as family and informal care, were additional common clusters, addressed in a large number of titles. Given the increase in lifespan, the entrance of women into the workforce, and the reduction in child birth, formal (paid) care has become a common practice in many countries (Albertini & Pavolini, 2015; Chenoweth & Lapkin, 2018). It is expected that the cost of long-term care and health care will increase substantially in OECD countries in the next few decades (De la Maisonnette & Martins, 2015). In contrast to the long-term and formal care cluster, the cluster of family and informal care, which covers informal care, is ranked fifth in terms of frequency of coverage in the scientific literature. This possibly reflects the worldwide transition towards reliance on formal care (Tong, 2009), which was ranked second in our analysis.

The least addressed topics were volunteering, sleep, addictions, suicide, and nutrition. The neglect of these topics is surprising, given the substantial implications all five topics have to the life and well-being of older adults. For instance, volunteering is an important topic as a large number of older adults tend to volunteer, and this has shown to result in great benefits to their health and mental health (Ayalon, 2008; Morrow-Howell, Hinterlong, Rozario, & Tang, 2003). In addition, both sleep and nutrition have a great influence on the health and functioning of older adults and can be seen as major risk factors for a variety of conditions (Amarantos, Martinez, & Dwyer, 2001; Foley, Ancoli-Israel, Britz, & Walsh, 2004; Miller, Edwards, Kissling, & Sanville, 2002; Mithal et al., 2013; Yaffe, Falvey, & Hoang,

2014) as well as symptoms of numerous medical and mental conditions (Kerstetter, Holthausen, & Fitz, 1992; Parish, 2009). Yet, sleep medicine was recognized as a specialty less than two decades ago, and nutrition is addressed by paramedical professionals. Hence, it is not surprising that both topics, which are at the outskirts of medicine, are underexplored in the field of gerontology.

The thematic cluster of addictions has received only minimal attention despite the fact that the United States, which constitutes the number one source of research articles in the field of gerontology, is currently undergoing a crisis due to the rise in opioid addiction (Compton & Volkow, 2006). Older adults, in particular, have shown to be at a risk for opioid addiction and prescription use disorders (Kalapatapu & Sullivan, 2010; West, Severtson, Green, & Dart, 2015). One possibility is that the topic of addictions among older adults is more likely to be acknowledged in the medical/geriatric literature, rather than in the field of gerontology (Maree, Marcum, Saghafi, Weiner, & Karp, 2016). Alternatively, it is possible that the underdiagnoses of addictions among older adults (Le Roux, Tang, & Drexler, 2016) is also reflected in the neglect of this topic by the gerontological scientific literature.

Suicide was minimally addressed according to the present classification. This is despite the fact that being an older man is a major risk for suicide in numerous countries worldwide (Heisel & Duberstein, 2005). Research has shown that physicians are less willing to provide treatment to older adults with suicidal ideation and more likely to view suicidal ideation as rationale in the case of older compared with younger adults (Uncapher & Areán, 2000). Hence, clearly, there is a great need to address the topic of suicide among professionals in the field of gerontology (Conwell, Van Orden, & Caine, 2011). The neglect of the topic by the scientific literature may reflect, but also impact the attitudes of health care professionals towards suicide in older adults.

An expected finding also evident in other fields (Caes et al., 2016), concerns the substantial increase in the number of articles produced over time, with almost 40% of all articles published in the past 60 years, being produced in the last decade. Research-wise, however, there has been limited change in the most dominant topics over the past three decades. Moreover, over a period of six decades, only five additional topics have gained scientific prominence at some point in time. Geriatric and gerontology research and education was a major cluster of interest in the 60s and 70s of the previous century as the field was in its infancy (Achenbaum, 1987; Achenbaum & Levin, 1989). Interventions too have received more attention in the early decades of the field, possibly as a reflection of its highly practical nature (Samanta, 2017). Similarly, the thematic cluster of mental health has received substantial attention in the 60s of the previous century. Possibly, with the publication of the first Diagnostic and Statistical Manual in 1952, mental illness has become a more specialized

topic that is now addressed in specialized journals. It is unclear, however, how much attention is given to gerontological issues in these more specialized scientific outlets. Hence, it is possible that older adults' mental illness is an underexplored scientific topic, as can also be attested by the substantial unmet needs of this population of older adults who suffer from mental illness (Solway, Estes, Goldberg, & Berry, 2010). It is important to note, however, that normative aspects of emotional functioning represent one of the largest thematic clusters.

The fact that the majority of the articles were produced by a first author from the United States is common in other fields of research as well (Caes et al., 2016; Rahman, Haque, & Fukui, 2005). This also is not surprising given the fact that only one of the journals reviewed was based outside the United States. What is somewhat surprising, however, is the fact that when research was published by researchers from other parts of the world, it addressed somewhat similar topics as the ones discussed by American researchers (e.g., cognitive functioning, physical functioning). Hence, there is only little heterogeneity within the field to allow for researchers from different countries to address topics that are beyond the scientific U.S.-led mainstream.

One thematic cluster that was unique to research conducted by authors from outside the Americas was country and nation. This is a reflection of the fact that the country of origin has to be explicitly stated in the title when researchers outside of the United States publish their work in scientific journals. Hence, when research is conducted outside of the Americas (the United States or Canada), its geographic origin has to be explicitly stated, but its focus confirms to the hegemonic scientific paradigm in power.

A notable finding concerns the fact that both the European and the Western Pacific regions tended to focus on topics that are psychological in nature, including emotional and personality functioning or mental health. This is contrasted with a greater focus on health and long-term care in the regions of the Americas. However, the overall limited variability in thematic clusters by geographic region could be accounted for by the fact that the journals outline their scope so that authors attempt to fit their research articles within the explicitly stated scope.

## Implications

Despite its innovative contribution, the present study has several limitations that should be acknowledged. First, the main analysis was conducted mechanically, using natural language processing. Although this also is a strength of the present study as the technique allows us to group a large amount of data into a smaller number of meaningful units with no a priori hypotheses, it is important to note that our manual review resulted in the reclassification of some of the contents. This suggests that the classification into thematic clusters may not be entirely accurate. Moreover, retrieval of titles through the on-line system is not without errors.

Furthermore, this classification was based on titles and might have been improved had we also used abstracts or entire manuscripts in the process. Another shortcoming of the present study concerns the focus on journals published in English and largely based in the United States. This likely biases the findings, which show a strong hegemony of U.S.-based science in the field of gerontology. It also is important to note that although limited variability in terms of thematic topics was found, it is possible that within each topic there is a greater depth of inquiry over time.

Despite its limitations, the present study critically reviews the literature in the field of gerontology. Our findings point to important areas of shortage of scientific attention and call for greater variability in the breadth of topics addressed by the scientific community over time and across geographic locations. As the strive to publish in high-impact-factor journals continues to fuel attempts of social and psychological sciences to resemble "pure" sciences (Simonton, 2004), even journals that explicitly aim to represent social and psychological aspects in the field of gerontology end up emphasizing biological, health and functioning over psychosocial issues. The findings further stress a need to move away from the biomedical perspective in order to give more attention to psychological and social issues in the field of gerontology.

## Supplementary Material

Supplementary data are available at *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences* online.

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## Author Contributions

L. Ayalon: Concept development, write-up, critical revisions; S. Lev: Analysis, write-up, critical revisions; G. Lev: Analysis, critical revisions.

## Conflict of Interest

None reported.

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