Review Article

Publication analysis on insomnia: how much has been done in the past two decades?

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ABSTRACT

Insomnia has been a rising public concern in recent years. As one example of a multidisciplinary topic, the theme of insomnia research has gradually shifted over time; however, there is very little quantitative characterization of the research trends in insomnia. The current study aims to quantitatively analyze trends in insomnia publications for the past 20 years. We retrospectively analyzed insomnia-related publications retrieved from PubMed and Google Scholar between 1994 and from a number of different perspectives. We investigated the major areas of research focus for insomnia, journal characteristics, as well as trends in clinical management and treatment modalities. The resulting 5841 publications presented an exponential growth trend over the past two decades, with mean annual growth rates at nearly 10% for each publication type. Analysis of major research focuses indicated that depression, hypnotics and sedatives, questionnaires, and polysomnography are the most common topics at present. Furthermore, we found that while studies on drug therapy and adverse effects decreased in the most recent five years, the greatest expansion of insomnia publications were in the areas of cognitive behavioral therapy for insomnia (CBT-I) and alternative therapies. Collectively, insomnia publications present a continuous trend of increase. While sedative and hypnotic drugs dominated the treatment of insomnia, nonpharmacological therapies may have great potential for advancement in future years. Future research effort is warranted for novel tools and clinical trials, especially on insomnia treatments with inadequate evidence or not-yet-clear efficacy and side effects.

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1. Introduction

Sleep medicine has been emerging with more public concerns over the past quarter century, which involves multidisciplinary fields of specialists, including pulmonology, neurology, cardiology, otolaryngology, psychology, psychiatry, endocrinology, geriatrics, pediatrics, dentistry, physiology, pharmacology, and even alternative medicine. Among a wide variety of sleep disorders, insomnia is a particular example that heavily involves multidisciplinary efforts. Insomnia is highly prevalent in clinical practice, independently or comorbidly with another medical or psychiatric disorder [1], and

its management usually involves clinicians or specialists from various academic backgrounds.

Since the number of academic publications is often considered as a trend of research interest and public attention at a given point in time [2–4], it is worth knowing the publication trends in sleep-related topics [5]. The biomedical literature is growing at a double-exponential pace [6], and it was reported that during the 1974–2004 period, sleep literature had increased fourfold, whereas overall total biomedical publications had only doubled [7]. Despite the large amount of sleep-related literature that has been published, the trend and focus of sleep research has been underdiscussed. Only a limited number of publication analyses have focused on specific sleep disorders, such as obstructive sleep apnea [8,9], and the research trend of insomnia remains underexplored.

Bibliometrics is a set of methods used to quantitatively analyze academic literature [4], and is useful in revealing historical development [2] and quantitative trends of publications [3]. The present

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study aims to quantitatively analyze trends in insomnia publications, in order to describe changes in the volume of insomnia-related research and to identify major research topics and treatment modalities over the past two decades. In this article, the following specific questions regarding insomnia will be addressed: What are major research focuses of insomnia? What journals publish insomnia research? What are the trends of demographic and clinical characteristics, and treatment modalities of insomnia research?

2. Methods

2.1. Search tools

PubMed was used for literature retrieval in this study. PubMed is a free resource that is developed and maintained by the National Center for Biotechnology Information, at the U.S. National Library of Medicine, located at the National Institutes of Health. PubMed was chosen because it has been the major search tool for scholars in the medical field. Early in 2009, PubMed was reported as receiving nearly 5 million queries each day by users worldwide [10]. Such access to publications keeps scholars updated and helps them to make discoveries in their own fields [11].

To analyze the trend and impact of certain topics of insomnia research, we used Google Scholar for citations and h-index analysis, which combines an assessment of both quantity of papers and their quality (including impact, or citations to these papers) [12]. Google Scholar-based metrics show strong correlations with the traditional Journal Impact Factors, which particularly benefit academic individuals publishing in sources that are not covered by the Institute for Scientific Information (ISI) [13]. Google Scholar and the h-index have been evaluated and used in many studies in the recent past [14–17].

This is a review article and does not involve a research protocol requiring approval by the relevant institutional review board or ethics committee.

2.2. Search strategies

To retrieve articles from PubMed, all literature searches were performed in March 2014, and further confirmed with the guidance of a professional medical librarian. To identify insomnia publications, an advanced search was set as MeSH term and publication date, for example, (insomnia[MeSH Terms]) AND ("1994/01/01"[Date – Publication] : "2013/12/31"[Date – Publication]). The total numbers of publications in each year were recorded from 1994 to 2013. Similar searches were then performed with filters for article types and text availability to specify the numbers of journal articles, clinical trials, randomized controlled trials (RCTs), or reviews, as well as the numbers of available full text or free full text articles. The past 20 years were grouped in 5-year increments to indicate trends via mean publication numbers. The annual growth rate (AGR) of publications was calculated as (Current Year Total – Previous Year Total)/Previous Year Total. The productivity index was calculated to compare the individual growth trend according to its baseline at year 1994, defined as (Current Year Total – 1994 Total)/1994 Total.

All data were retrieved using PubMed's XML export function. Major information was extracted including the years of publication, titles of articles, journal names and their ISO abbreviations, languages, and article types. The XML file was processed by a customized software, and all results were manually checked by the authors. MeSH terms, MeSH major topics, and MeSH subheadings were also included for further analyses. In PubMed, MeSH terms

are arranged hierarchically by subject categories with more specific terms arranged beneath broader terms. Applying the MeSH vocabulary ensures that articles are uniformly and systemically indexed by research topic, regardless of the keywords provided by the authors [18]. Therefore, it became possible to analyze the major topics in each article and to see the change of focus through the years. In addition, the top 20 journals ranked by the total numbers of insomnia publications over the entire study period (1994–2013) were reported. Furthermore, to study the impact of pharmacological and nonpharmacological treatment of insomnia, we used the terms identified in PubMed literature analyses as the search terms in Google Scholar to determine the citations normalized by the age of publication and h-index.

2.3. Statistical analyses

SPSS 19.0 (IBM SPSS Statistics) software was used for statistical analyses. Descriptive statistics were reported as mean ± standard deviation. Differences in the publication number across each 5-year group were assessed by one-way analysis of variance. Exponential regression was applied to assess the publication trends. A p value of <0.05 was considered statistically significant in analyses of variance or regression models.

3. Results

3.1. Quantity of insomnia publications

In PubMed, we used "insomnia" as the main search term using the "exploded" feature (insomnia[MeSH Terms]) AND ("1994"[Date – Publication] : "2013"[Date – Publication]). Results revealed 5841 publications, including 5382 (92.1%) journal articles, composed of 1026 (17.6%) clinical trials, 716 (12.3%) RCTs, and 242 (4.1%) multicenter studies. Among them, only 25 (0.4%) articles were phase I, II, III, or IV clinical trials. There were 446 (7.6%) case reports, 1176 (20.1%) reviews, 237 (4.1%) systematic reviews, and 55 (0.9%) meta-analyses. Among all, 4603 (78.8%) were full-text available, and 1232 (21.1%) were open-access. Table A1 in the Appendix shows the numbers of each type of literature in each 5-year period. Analyses of variance show that the number of publications was significantly different across each 5-year period and also among different journal types. The number of insomnia publications (Fig. 1a) showed an exponential trend and increased more than four times in the past two decades, whereas the general biomedical publications only doubled (Fig. 1b). Fig. 1c shows the trends of insomnia research by publication types.

3.2. Main research focus of insomnia publications

Table 1 shows the top 20 descriptors (ie, keywords) that appeared in retrieved articles. Top rankings included publications on depression-related issues, hypnotic/sedatives, use of questionnaires, and polysomnography. Table A2 in the Appendix shows the top 10 categories of insomnia research in each 5-year period. It is noteworthy that articles on drug therapy dropped from 46.3% in the first five years to 29.6% in the most recent five years. Similarly, the percentage of publications focusing on adverse effects also decreased significantly. Expansion of insomnia publications was seen mostly in the area of psychology/psychotherapy and other nonpharmacological therapies. The focus on epidemiology and insomnia complications also drew more attention, with increasing trends in publications in the most recent 10 years. Other common research topics, such as physiology, etiology, diagnosis,