

# A bibliometric analysis of the scientific literature on Internet, video games, and cell phone addiction\*†

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**Objectives:** The aim of this study was to locate the scientific literature dealing with addiction to the Internet, video games, and cell phones and to characterize the pattern of publications in these areas.

**Methods:** One hundred seventy-nine valid articles were retrieved from PubMed and PsycINFO between 1996 and 2005 related to pathological Internet, cell phone, or video game use.

**Results:** The years with the highest numbers of articles published were 2004 (n=42) and 2005 (n=40). The most productive countries, in terms of number of articles published, were the United States (n=52), China (n=23), the United Kingdom (n=17), Taiwan (n=13), and South Korea (n=9). The most commonly used language was English (65.4%), followed by

Chinese (12.8%) and Spanish (4.5%). Articles were published in 96 different journals, of which 22 published 2 or more articles. The journal that published the most articles was *Cyberpsychology & Behavior* (n=41). Addiction to the Internet was the most intensely studied (85.3%), followed by addiction to video games (13.6%) and cell phones (2.1%).

**Conclusions:** The number of publications in this area is growing, but it is difficult to conduct precise searches due to a lack of clear terminology. To facilitate retrieval, bibliographic databases should include descriptor terms referring specifically to Internet, video games, and cell phone addiction as well as to more general addictions involving communications and information technologies and other behavioral addictions.

Behavioral addictions are an emerging phenomenon whose existence, except for pathological gambling, is questioned by the scientific community [1]. Even gambling has been categorized in the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, text revision (DSM-IV-TR) as a condition affecting control of impulses and not as a problem of dependence [2]. Regardless of how they are classified, the study of behavioral addictions is interesting in and of itself and as a way of gaining an increased understanding of the psychological aspects of substance addiction.

One behavioral addiction that has received considerable media attention is the pathological use of certain information and communications technologies (ICT), such as the Internet, cell

phones, and video games. The media tend to highlight the negative consequences and addictive properties of these technologies, often on the basis of single cases or opinions that are difficult to validate [3]. The Internet and the media also report on specialized clinics that treat these addictions in countries as widely dispersed as the United States [4, 5], China [6, 7], Germany [8], and Spain [9]. Consequently, the public may come to believe in excessive use of these technologies or maladaptations, both common phenomena in the adaptation to new technologies.

An analysis of scientific publication related to ICT addiction was performed to determine what type of research is being conducted, who is doing the research, and where this research is taking place, as well as to document what the trends in publication are over time. To find the maximum number of publications, two large bibliographic databases were searched: PubMed, which provides broad coverage of the biomedical sciences, and PsycINFO, which indexes the literature of psychology. The aim of the present study was to analyze the pattern of scientific publication on addiction to ICT over a ten-year period (1996–2005).

## MATERIALS AND METHODS

Articles indexed in PubMed and PsycINFO between 1996 and 2005 related to the pathological use of Internet, cell phones, and video games were

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## Highlights

- Scientific publications relating to Internet, video game, and cell phone addiction are increasing.
- Addiction to information and communications technologies (ICT) is a new field for which database thesauri do not yet include specific terminology, thus making document retrieval difficult.
- Classifying articles by type of ICT shows that Internet addiction is studied more frequently than addiction to cell phones or video games.

## Implications

- Because the scientific literature is dispersed across many different journals in different subspecialties, more than one database must be searched to locate all relevant literature.
- Retrieval of relevant information would be improved if bibliographic databases included terms referring to ICT addiction, including Internet addiction, video game addiction, and cell phone addiction.
- When indexing some disorders, such as ICT addiction, college students should be included as a category or a limit term in the thesauri or indexing terms.

retrieved.<sup>‡</sup> To obtain the maximum number of relevant articles, a variety of search strategies were tested in each database.

The PubMed database <<http://www.ncbi.nlm.nih.gov/sites/entrez/>> was searched on January 21, 2006. In the absence of specific Medical Subject Headings (MeSH) terms for the addictions under study, a strategy was adopted that included the MeSH terms most closely related to these topics:

("Internet"[MeSH] OR "Cellular Phone"[MeSH] OR "Video Games"[MeSH] OR "Computer Systems"[MeSH] OR "Computers"[MeSH]) AND ("Impulse Control Disorders"[MeSH] OR "Obsessive-Compulsive Disorder"[MeSH] OR "Anxiety Disorders"[MeSH] OR "Mood Disorders"[MeSH] OR "Impulsive Behavior"[MeSH] OR "Behavior, Addictive"[MeSH])

Searches were limited to Entrez Date from 1996/01/01 to 2006/01/20 and publication date from 1996/01/01 to 2005/12/31.

A similar search strategy was used to retrieve the articles indexed in PsycINFO:

<sup>‡</sup> The authors originally intended to include data from the period 1991–1995, but only 5 articles were retrieved. Four of them were published in the United Kingdom, were in English, and were published in *Addictive Behaviors* (n=2), *Journal of Adolescence* (n=2), and *Occupational Health* (n=1). The first authors were affiliated with universities in 2 of them, and affiliation was not present or could not be assigned for the others. Three of the articles had 3 authors. In 4 cases, the technology studied was video games, and 3 of the studies were empirical.

**Table 1**

Year of publication of information and communications technologies (ICT) articles indexed in PubMed and PsycINFO

Year of publication	PsycINFO	PubMed	Total (duplicates removed)	
			n	(%)
1996	0	4	4	(2.2)
1997	4	2	4	(2.2)
1998	5	2	6	(3.4)
1999	11	4	14	(7.8)
2000	6	6	11	(6.2)
2001	16	7	21	(11.8)
2002	15	7	19	(10.6)
2003	18	7	18	(10.1)
2004	38	15	42	(23.5)
2005	32	14	40	(22.4)
Total	145	68	179	(100.0)

(DE="Telephone Systems" OR DE="Computer Games" OR DE="Computers" OR DE="Electronic Communication" OR DE="Internet" OR DE="Technology" OR DE="Computer Mediated Communication") AND (DE="Addiction" OR DE="Internet Addiction" OR (DE="Internet Addiction" OR DE="Impulse Control Disorders" OR DE="Pathological Gambling"))

Search options used included: publication year from: 1996–2005, document type: Journal Article, search modes: Boolean/Phrase.

Two researchers (Guardiola and Carbonell) reviewed search results to eliminate articles that were not relevant. Duplicates were removed from the final list of analyzed articles. Year of publication; country of origin of the first author; language of publication; journal; affiliation of the first author; number of authors; subject area (Internet, cell phone, video games); study population (children, adolescents, college students or equivalent, adults); and research level (empirical, not empirical, clinical case; the classification of methodologies used by PsycINFO database) were recorded. A descriptive statistical analysis of the data was performed.

## RESULTS

The bibliographic search for addictions to Internet, online video games, or cell phones between 1996 and 2005 yielded 145 relevant articles of 148 retrieved in PsycINFO and 68 relevant articles of 240 retrieved in PubMed. Once duplicates had been eliminated, 179 valid articles remained.

### Publication year

Between 1996 and 2000, 39 articles were indexed and between 2001 and 2005, 140 (Table 1). The largest number of articles was published in 2004 (n=42) and 2005 (n=40).

### Country of first author

The most productive countries were, in order of productivity, the United States (n=52), China (n=23), the United Kingdom (n=17), Taiwan (n=13), South Korea (n=9), Spain (n=7), and Australia (n=6).

**Table 2**  
Journals publishing more than one article on addiction to ICT, 1996–2005

Journal	Number of articles
<i>Acta Psychologica Sinica</i>	2
<i>American Journal of Psychiatry</i>	2
<i>Archives de Pediatie</i>	2
<i>Canadian Journal of Psychiatry</i>	3
<i>Chinese Journal of Clinical Psychology</i>	4
<i>Chinese Journal of Psychology</i>	2
<i>Chinese Mental Health Journal</i>	10
<i>Cyberpsychology &amp; Behavior</i>	41
<i>Computers in Human Behavior</i>	5
<i>International Journal of Human Computer Studies</i>	2
<i>Journal of Affective Disorders</i>	2
<i>Journal of Employment Counseling</i>	2
<i>Journal of Nervous and Mental Disease</i>	2
<i>Journal of Preventive Medicine and Public Health</i>	2
<i>Perspectives in Psychiatric Care</i>	2
<i>Psicologia Conductual</i>	3
<i>Psychiatria Hungarica</i>	3
<i>Psychiatry and Clinical Neurosciences</i>	2
<i>Psychological Reports</i>	4
<i>Psychological Science (China)</i>	6
<i>Psyke and Logos</i>	2
<i>Wiener Klinische Wochenschrift</i>	2

Authors from France and Hungary published 4 articles; Belgium, Canada, and Germany published 3; Hong Kong, Denmark, Italy, Japan, Norway, Poland, Sweden, and Turkey published 2; and Czechoslovakia, Finland, The Netherlands, India, Ireland, and Switzerland each published 1 article. The country of the first author was not specified in 13 articles.

### Publication language

The most commonly used language was English (n=117, 65.4%), followed by Chinese (n=23, 12.8%); Spanish (n=8, 4.5%); French (n=7, 3.9%); German (n=6, 3.4%); Korean, Hungarian, and Italian (n=3 each); and Danish, Polish, and Turkish (n=2 each); and 1 document was published in Dutch, Japanese, and Serbo-Croatian.

### Journals

A total of 96 different journals published the 179 articles retrieved on the pathological use of Internet, cell phones, and video games (i.e., an average of 1.85 articles per journal). Table 2 presents in alphabetic order the 22 journals that published 2 or more articles on ICT. In the period 1996–2000, the journal that published the most articles was *Cyberpsychology & Behavior* (n=14), well ahead of the journal ranking second, *Psychological Reports* (n=3). Between 2001 and 2005, the journal that published the most articles was again *Cyberpsychology & Behavior* (n=27), followed by *Chinese Mental Health Journal* (n=10) and *Psychological Science (China)* (n=6). These journals, plus *Computers in Human Behavior* (n=5) were the ones that jointly accounted for the majority of articles published over the entire 10-year period. The remaining 74 journals published 1 article each.

**Table 3**  
First author affiliation for ICT articles retrieved from PubMed and PsycINFO

Institution type	1996–2000	2001–2005	Total
University (department, faculty, school)	29	105	134
Business, administration, marketing	0	5	5
Psychology	14	40	54
Telecommunications, informatics	0	3	3
Education, teacher education	0	8	8
Journalism	0	6	6
Medicine, psychiatry, nursing	8	21	29
Public health	0	2	2
Science and technology	0	3	3
Humanities, social sciences	3	3	6
Department not specified	4	14	18
Hospital	1	9	10
Mental health center	1	3	4
Research institute	1	5	6
Not specified or difficult to ascertain	7	18	25

### Institution of the first author

In Table 3, the articles are classified by the type of institution with which the article's first author was affiliated. Most authors were affiliated with a university (n=134, 74.9%); specifically, they were members of the following kinds of faculties, schools, or departments: psychology (n=54, 30.2%); medicine, psychiatry, and/or nursing (n=29, 16.2%); and education (n=8, 4.4%). Other types of institution were, in order of frequency, hospitals, mental health centers, and research institutes.

### Number of authors

Articles were classified on the basis of the number of authors. One article did not list the authors and was not included in the analysis of number of authors. Over the 10-year period, a total of 73 articles (41.0%) were signed by 1 author, 55 (30.9%) by 2, 24 by 3 (13.5%), 15 by 4 (8.4%), 7 by 5 (3.9%), and 4 by more than 5 authors (2.2%). A decline was observable in the number of articles signed by only 1 author when comparing the first 5-year period with the second (falling from 56.4% to 36.5%). The index of collaboration was 2.13.

### Type of information and communications technology

Among a total of 184 articles (5 articles were ascribed to 2 categories), addiction to the Internet was the most commonly studied (n=155, 84.2%), followed by addiction to video games (n=18, 9.8%), online video games (n=7, 3.8%), and cell phones (n=4, 2.2%). The latter 2 were only studied in the period from 2001–2005.

### Population

In analyzing the populations studied in the articles, it must be noted that 13 articles were assigned 2 or more population groups, 10 did not specify population, and 43 were review articles or book reviews and hence the concept was not applicable. Therefore, the population

studied could be identified for 142 articles: 53 (37.3%) involved studies among adults, 42 (29.6%) adolescents, 39 (27.5%) university students, and 8 (5.6%) children.

### Type of study

The studies were mainly empirical, a tendency that increased in the second 5-year period. Over the entire 10-year period; 58.1% of the articles were empirical; 34.6% were nonempirical (review, opinion, editorial, book review); 6.1% dealt with clinical cases; and 2 were not specified. Using the classification scheme for articles suggested by Niemz, Griffiths, and Banyard [10], the researchers classified the subject areas of the empirical articles on Internet addiction into 4 large groups: studies comparing excessive users of the Internet with non-excessive users (n=51); studies of cases of excessive Internet users (n=9); studies examining psychometric test properties for evaluating excessive Internet use (n=8); and studies examining the relationship between excessive use and other behaviors, psychological problems, depression, loneliness, and so on (n=24).

### Tests used

The PsycINFO database provides the names of tests and questionnaires used in articles that are identified as empirical. The tests used in empirical PsycINFO articles retrieved in this study were classified in two groups: "Measurement of addiction" and "Evaluation of personality and other variables." Studies of measurement of addiction to the Internet employed seventeen different tests. The most frequently used tests were: Internet Addiction Test (IAT-Young), seven times; Chen Internet Addiction Scale (CIAS), four times; and Diagnostic Questionnaire for Internet Addiction and Internet Addiction Disorder Scale, two times each. Thirty different tests were used to evaluate personality and other variables, of which the most frequently used tests were: Eysenck Personality Questionnaire-Revised (EPQ-R), four times, General Health Questionnaire (GHQ), Symptom Checklist-90 (SCL-90), and University of California-Los Angeles (UCLA) Loneliness Scale, three times each; and Sixteen Personality Factor Questionnaire (16-PF), Children Behavior Checklist (CBCL), Cooper-smith Self-Esteem Inventory, Minnesota Multiphasic Personality Inventory (MMPI)-2, Rosenberg Self-Esteem Scale, and Zuckerman's Sensation Seeking Scale, two times each.

### DISCUSSION

The present work studied the patterns of published scientific literature on the pathological use of certain ICT such as the Internet, cell phones, and video games. The study used two bibliographic databases, one biomedical (PubMed) and one psychological (PsycINFO), as both scientific disciplines are directly involved in the study of this condition.

This study has been particularly useful in highlighting certain problems in developing search strategies for locating material on ICT and therefore in deriving firm conclusions from the results. This is a new field for which thesauri do not yet include specific relevant terminology, thus making document retrieval difficult. Because researchers have not come to any agreement on terminology, a variety of different terms are used in article titles and abstracts. Thus, for example, in the case of "addiction" to the Internet, "Internet addiction" (IA), "Internet addiction disorder" (IAD), "pathological Internet use" (PIU), "problematic Internet use," and "unregulated Internet usage" are just a few of the more widely used terms. The lack of agreement on classification presents additional difficulties when trying to construct a comprehensive search strategy. Researchers such as Young [11] consider addiction to *online* sex and gambling as subtypes of addiction to Internet, while others [12] consider these two conditions subtypes of addiction to sex and gambling, respectively.

Given the large number of terms used to describe ICT, improvements in indexing and assignment of keywords would likely result in retrieval of an increased number of relevant articles. It would be beneficial for bibliographic databases to incorporate, in their descriptors, a term referring to ICT-related addictions, including Internet addiction, video game addiction, and cell phone addiction. The growing number of publications on these topics justifies such an addition and should improve search results. The absence of such terms probably accounts for the large number of nonrelevant documents obtained when searching PubMed. Prior to adopting the search strategy reported here, other strategies were tested. For example, a previous tentative search strategy in PubMed used free text:

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Search internet OR online OR chat OR computer* OR virtual
OR "video game*" OR "computer game*" OR "cyber* OR
"mobile phone*" OR "cellular phone*" AND (addict* OR
overuse OR (excessive AND (use OR usage)) OR (maladaptive
AND (use OR usage)) OR (pathological AND (use OR
usage)) OR (problematic AND (use OR usage)) Limits:
Entrez Date from 1996/01/01 to 2006/01/20, AND Publication
Date from 1996/01/01 to 2005/12/31
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This search retrieved 582 articles, but only about 12% of them (also retrieved with the MeSH search) were relevant. By contrast, the strategy used to locate the results reported here exclusively employed the MeSH terms associated with these addictions. In that search, 240 articles were retrieved but only 68 (28%) were relevant. To increase precision, it would be very useful to have specific MeSH terms for these kinds of addictions.

Obviously the problem of indexing articles is overshadowed by the greater conceptual problem of how these addictions should be classified in the first place. Should ICT addictions be classified as substance dependence, as an impulse control disorder like pathological gambling, or as an impulse control disorder not otherwise specified? The point of view of

Hollander and Allen [13] is that Internet addiction is an impulse control disorder included in the category of behavioral and substance addiction. Recently, Block [14] stated that Internet addiction is a common compulsive-impulsive disorder that merits inclusion in DSM-V. It will become important to update both thesauri and search terminology when DSM-V appears in 2010.

Keeping the limitations imposed by lack of specific index terms in mind, this study has provided information on several aspects of the ICT literature. Coverage of this field in the scientific literature is increasing. The number of articles published in scientific journals on addiction to ICT increased over the ten-year period studied, particularly between the years 2001 and 2005, exceeding forty per year in 2004 and in 2005. This growth is even more notable considering that between 1991 and 1995, using the same search strategies, only five articles were retrieved.

Twice as many articles were retrieved from the bibliographic database covering psychology than from that covering biomedicine. This might be due to the fact that addictions to technologies are studied more from a psychological and social perspective than from a biological or medical perspective.

The most productive countries were the United States and United Kingdom, as happens in other similar scientific disciplines, including drug dependency [15], although there was a striking contribution from Asian countries such as China, South Korea, and Taiwan. Authors came from a total of twenty-three different countries (a very dispersed production), demonstrating that there was scientific interest in the topic in North America, Europe, and Asia.

The most extensively used publication language was English, followed at a distance by the other languages as also happens in other scientific disciplines and particularly in the field of drug addiction [16]. However, in this case the percentage of articles in English was lower than in the field of drug addiction, probably because PsycINFO indexes journals such as *Acta Psychologica Sinica* and *Chinese Mental Health Journal*, which are published in Chinese, the second most commonly used language.

The journal that published the most articles on pathological use of Internet, cell phones, and video games was *Cyberpsychology & Behavior*, indexed by both databases, confirming this journal as a primary source of scientific information regarding this condition. The other articles appeared in journals covering other aspects of psychology, mental health, education, computers, gambling, and adolescents suggesting that research in ICT was spread across numerous disciplines. Because publications in the area were spread across so many different journals (76.3% of journals had only published 1 article on the subject), retrieval and study is difficult. This dispersion was greater than that observed in other bibliometric studies dealing with similar topics such as drug addiction in the European Union [15], Spanish scientific production on drug dependence indexed in MED-

LINE [16], and scientific literature on designer drugs indexed in PubMed [17].

Most first authors belonged to a university, specifically they belonged to faculties or departments of psychology, psychiatry, and/or medicine and departments of education. It is possible that those affiliated with medical faculties were in departments of psychiatry, although it is difficult to ascertain this point because of the many different ways in which institutions are named and addresses listed. These data confirmed the fact that the negative repercussions of use of ICT were studied more frequently in psychology than in other ICT-related disciplines. More than 71% of articles were signed by 1 or 2 authors. The index of collaboration was 2.13, lower than that found in articles published in journals specializing in addiction [15, 17–19].

Classifying the articles by type of ICT showed that addiction to the Internet was the area of ICT most frequently studied, with a very few studies on online video games or addiction to cell phones published in the second 5-year period. Interestingly, the amount of popular interest in the topic seemed to correspond to scientific concerns. A basic search with Google in October 2008 yielded 224,000 entries to “video game addiction,” 14,700 to “telephone addiction,” and 580,000 to “Internet addiction.”

More than half the articles studied the addictive behavior of adolescents and university students, likely reflecting characteristics of adolescent and university student life style. Psychological characteristics typical of adolescents include feelings of omnipotence, a tendency to seek the causes of their own problems in the behavior of others, lack of experience in life, difficulty in recognizing subtle addictions, and beliefs that situations involving risk behavior are normal [20]. Moreover, university students are in their early youth, many of them live away from home, live or are beginning to live a new life of stress and unknowns, have a need for contact with friends living in other places, and have free access to Internet in their faculties and residences [10, 21–23]. As ICT disorders appear to be especially relevant for college students, it would be very helpful for databases to include this group as a population category for indexing.

The retrieved articles were mainly empirical, a trend that increased in the second five-year period. The subject area of the majority of the articles was comparison of excessive and non-excessive Internet users and the relationship of addiction to Internet with other psychological variables. The studies employed a considerable variety of tests and questionnaires, specifically on addiction to Internet and on psychological variables. The most extensively used tests in evaluating Internet addiction were Young's IAT and Chen's CIAS and, for evaluating psychological variables, the EPQ-R, the GHQ, the SCL-90, and the UCLA Loneliness Scale.

In conclusion, the number of publications in this area is growing, but it is difficult to conduct precise searches due to a lack of clear terminology. To

facilitate retrieval, bibliographic databases should include descriptor terms referring specifically to ICT addiction. In the future, it would be interesting for bibliometric studies to analyze whether the literature of ICT addiction grows faster in Asian countries and if there is a trend of concentrating research publications in a few journals.

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