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► **To cite this version:**

Marcin Trzmielewski. Representation of Students' Mental Health in Information Resources and in Medical Knowledge Organization Systems. La santé mentale sur les campus universitaires face aux défis contemporains : de la discrimination à la COVID-19. Regards croisés : Communication, Droit et Psychologie., Oct 2020, Toulouse, France. hal-03357517

HAL Id: hal-03357517

<https://hal.science/hal-03357517>

Submitted on 28 Sep 2021

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**SMCU2020 Colloquium
26-27 October, 2020**

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Representation of Students' Mental Health in Information Resources and in Medical Knowledge Organization Systems

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Introduction

Mental health issues, such as depression, anxiety, eating disorders, suicidal ideation, and self-injury, are commonly experienced by university students (Zivin *et al.* 2009). These disorders are a real burden for this specific population, and they may impair their academic productivity, social life and even hamper their future career (Davies *et al.* 2014). As mental health is an important and complex issue for public health, according to the WHO's *Mental Health Action Plan 2013-2020*, a multidisciplinary approach is needed (World Health Organization 2013). The present paper was a part of a study in Information and Communication Sciences (in French: *Sciences de l'Information et de la Communication*), which is a multidisciplinary academic discipline aiming to study information and communication-related phenomena with an interdisciplinary approach (CNU 2020; Couzinet 2006). We mainly exploited epistemology and methods from Library and Information Science and from Knowledge Organization field of research and practice (Hjørland 2016). Our aim was to enrich reflection on students' mental health by highlighting that documentary mediation processes and tools, and, more precisely, subject indexing and indexing languages, may be an interest source of data about representation of this issue in scientific and in general-public information.

Medical and health information

Information resources¹ provided by documentation services (e.g. catalogues, bibliographic databases, institutional websites) and social media (e.g. forums, social bookmarking and cataloging websites) seem to have an important role in transmitting information about students' mental health both among specialists and wide public. Our contents assessment on the PubMed² and on the National Library of Medicine blog³, online services delivered by the National Library of Medicine (NLM), showed that this medical library mostly harbors specialized, validated, and high-quality information on this topic. Moreover, as Walton (2018) highlights, academic libraries have an important role in supporting student's wellbeing by providing physical space, digital support, and collection provision. Concerning social media, the study of Kvasny and Payton (2018) shows, by using the example of Tumblr®, that microblogging and social networking websites, may provide a powerful mental health support to college students. Furthermore, posts on Twitter® regrouped by hashtag “#StudentMentalHealth”⁴ highlight that social media may be spots of exchange of public information on this topic.

Documentation and social media services reflect the current coexistence of two kind of information in healthcare domain: medical information and health information (Romeyer 2008). We consider *medical information* as a type of specialized content focusing on health-related phenomena, produced by specialists for specialists, and exchanged for example through scientific articles, books, electronic health records and conversations between health professionals. On the contrary, *health information* is a kind of information, which is produced by several actors, such as health insurances, pharmaceutical industry, health consumers, intended for the wide public (Romeyer 2008; Romeyer and Paillart 2006). As Paganelli and Clavier (2014) highlight, these two types of information tend to complement themselves. Indeed, as studies on Information Seeking in Health show, whether they are conducted in (library and) information science or in medicine, health professionals willingly share contents with their colleagues and health consumers on microblogging and social networking services, health fora, and blogs (Beylot Daudigeos 2019; Bouarfa 2018; Dor 2014; Gonzalez-Pacanoski and Medina-Auguerrebere 2011; Paganelli and Clavier 2014). At the same time, health consumers are interested in specialized information as well: for example, some parents go on bibliographic databases or official websites of public health authorities to inform themselves about vaccination in children (Vivion 2018).

Organization of medical and health knowledge

To mediate and enhance the visibility of medical and health information, both humans (information and documentation professionals or users) and computer programs are used to organize knowledge (Trzmielewski and Gnoli 2021), i.e. describe, represent, fil and organize documents and document representations, as well as subjects and concepts (Hjørland 2016). Medical Knowledge Organization Systems (MKOSs), such as taxonomies, folksonomies, classifications, nomenclatures, thesauri, ontologies, and consumer health vocabularies are structured records made up of concepts and relationships between these concepts, which represent knowledge relating to different domains of medicine and related disciplines (Trzmielewski and Gnoli 2021). MKOSs are used to organize medical and health information and to enable access to documents in physical and digital libraries, in healthcare organizations and on the Web. They often aim to represent the content of documents by expressing their subject (a phenomenon or a perspective) through concepts, represented by

¹ Information resources are any infrastructure or material that provides content and information services for the user (Elaturoti 2019).

² We analyzed a dozen of articles found on PubMed through the query "Students/psychology".

³ We analyzed a dozen of articles published on National Library of Medicine blog (category *Scholarship and Grants*). Articles are available at: <https://news.nlm.gov/bhic/category/scholarships-and-grants/> (Accessed 29 April 2021).

⁴ We analyzed a dozen of posts regrouped by this hashtag. These Tweeter posts are available at: https://twitter.com/search?q=%23StudentMentalHealth&src=typed_query (Accessed 29 April 2021).

terms, which are originated from common-usage words. In addition, with some MKOSs, it is possible to describe documents, collections, and people-related information, according to their information needs and cognition (Trzmielewski and Gnoli 2021). As examples of such systems we may recall the National Library of Medicine Classification, which is extensively used in health libraries to classify books on the shelves (Womack 2006); the Medical Subject Headings (MeSH), mobilized often to index contents on library online catalogs and bibliographic databases (Boehr 2018); the OntoNeo ontology, developed to assist neurosurgeons in retrieving and accessing relevant patient records (Raghavan and Sajana 2010); and folksonomies, which are tags, keywords and hashtags created by social media users through the social tagging process, which may be explained as collaborative indexing of contents (Ådland and Lykke 2018). As all knowledge organization systems (KOSs), we may consider MKOSs as vehicles or systems of communication between authors of documents, professionals of information and documentation, and users, enabling documentary mediation between these actors (Couzinet 2006; Lazzari 1982; Régimbeau 2011).

Apart from document and information retrieval, MKOSs “can be used to gauge societal thinking” (Huber and Gillaspay 2000, 222), and to increase awareness on the sensitive nature of health in the population, through the mediation of scientific, social, political and cultural phenomena (Trzmielewski and Gnoli 2021). This point of view inspired for example Huber and Gillaspay (2000) to study the discourse of homosexuality transmitted by MKOSs.

In the present work, we decide to examine and describe the representation of students’ mental health, as reflected in MeSH terms created and used by NLM professionals to index documents on PubMed, and as evidenced by tags created by users on LibraryThing to index books cited on this web application. PubMed⁵ is an interface of search in MEDLINE, which is a bibliographical database used to index and abstract scientific books and articles in biomedical domains. LibraryThing⁶ is a social cataloging web 2.0 application for storing and sharing book catalogs and various types of book metadata. By taking into consideration paratextual contents communicated through PubMed and LibraryThing, we expect to discover respectively scientific and wide-public discourse on the subject of students’ mental health and to highlight goals and values related to this phenomenon associated to the common representation of this topic.

Methodology

Firstly, we searched for scientific articles published on students’ mental disorders, abstracted on PubMed, and for books on these themes catalogued on LibraryThing. On PubMed, we used the query: “student mental [Title]” and we filtered publications by “Journal articles”. On LibraryThing, we consequently queried the browser with the keywords “student mental health” and “mental health students”, and we filtered works by “Books”.

Then, we qualitatively gathered information on the authors of the analyzed works (discipline of specialization and affiliation).

Finally, we classified indexing terms on PubMed and on LibraryThing into emerging facets. Facets may have syntactic and semantic function (Hudon 2020), but in the present work they are only considered as “semantic containers” regrouping similar terms into main classes. Within the facets, we developed thematic subclasses, and connected them to the content of articles, if the meaning of terms were not entirely explicit. We compared and merged terms from the two sources and we added terms from bibliographic analysis of works to obtain a

⁵ PubMed is available at: <https://pubmed.ncbi.nlm.nih.gov/> (Accessed 29 April 2021).

⁶ LibraryThing is available at: <https://www.librarything.com/home#> (Accessed 29 April 2021).

common representation. Obtained representation was presented in the form of taxonomy sample.

Results

Articles and books cited on PubMed and on LibraryThing

The query used to search for documents on PubMed provided 93 articles published between 1957 and 2020. On LibraryThing, we obtained 86 books, but results were not accurate, and consequently needed to manually select them qualitatively. After the selection, we included 50 books in our analysis, and we collected 53 unique tags created by users to index them. We did not establish temporary limits to collect terms on LibraryThing, considering that the application was launched in 2005, which conducted us to obtain recent data only (2005-2020). After that, we collected 212 unique MeSH terms from the last 15 years (2005-2020), used for indexing 59 articles, to obtain a comparative sample.

Results of our request on PubMed (93 articles) highlight that, while, during several decades, students' mental health topic was often neglected, the number of publications has considerably raised over the last 15 years (2006-2020) (Figure 1).



Figure 1 – Yearly visualization of works found on PubMed. In grey, we can see all available publications (1957-2020) and, in turquoise, our included sample (2005-2020). The number of publications by decade is: 1950s – 1; 1960s – 7; 1970s – 15; 1980s – 6; 1990s – 3; 2000s – 6; 2010s – 48; 2020s – 7.

The articles on PubMed selected for our semantic analysis of indexing terms (59) are written by consultants and researchers in medicine (psychiatry, neurology, addictology, nursing, public health, pediatrics) and social sciences (psychology, anthropology, education, economics, social work). Publications are first of all issued from journals specialized in different disciplines, such as: psychiatry (*e.g. Australasian Psychiatry, Early Intervention in Psychiatry, Frontiers Psychiatry*), psychology (*Psychological Assessment, Psychological Reports, Psychological Services*), medical education (*BMC Medical Education, Medical Education, American Journal of Pharmaceutical Education*), nursing (*Journal of Advanced Nursing, Nurse Education Today, Journal of School Nursing*) and public health (*Journal of American College Health*). We may also find articles published in cross-disciplinary journals dedicated to specific phenomena: mental health in general (*Journal of Mental Health, International Journal of Mental Health Promotion*), mental health of specific populations (*Journal of American College Health*), depression and anxiety (*Depression and Anxiety*), cognitive behavior (*Cognitive Behaviour Therapy*), suicide (*Crisis*), addiction (*Addictive Behaviors*). Finally, some articles appear in general medical journals (*British Medical Journal, RAND Health Quarterly, Academic Medicine*).

Books cited on LibraryThing were written by specialists in medicine (child and adolescent practitioners, researchers or teachers in psychiatry and in mental health nursing) and social sciences (counseling psychologists, researchers or academic teachers in counseling, educational psychology, and social work). In these works, the subject of students' mental health and wellness is often treated and studied by disciplines such as education (teaching), counseling psychology, social work, and mental health nursing. Most books are textbooks and guides including fundamentals and case-based intervention strategies for teachers,

parents, students, social workers, and mental health professionals (mental health nurses, psychiatrists, school psychologists and counselors) working with college and university students.

This panorama of different disciplines engaged in students' mental health, noticeable on PubMed and on LibraryThing, highlights that this is clearly a multidisciplinary domain and subject, which combines medicine and social science. Journals dedicated to specific phenomena (*e.g.* suicide, addiction) instead of disciplines also witness that, as a topic, students' mental health has an interdisciplinary nature as well. The information mediated by works cited on these devices is specialized: purely scientific on PubMed and somehow more popularized on LibraryThing (*e.g.* several books are also dedicated to parents; guides are more accessible in terms of simplicity of writing style than scientific articles).

Indexing on PubMed and on LibraryThing

To accurately index subjects discussed in documents cited on PubMed, indexing professionals from the NLM are assisted by a set of methods and rules and by NLM Medical Text Indexer – an indexing tool based on Natural Language Processing technology (National Library of Medicine 2018; 2019; 2020). Accounts on LibraryThing are anonymous and that is why it is difficult to know who is behind them. Its community members refer to themselves as “thingamabrarians”, being “a community brought together by the love of books” (The LibraryThing Blog 2013). Rolla (2009) clearly describes how the application works: “LibraryThing contains a comprehensive list of books, but, like other Web 2.0 sites, it allows users to interact with the content and supply their own data. Users of LibraryThing can create their own virtual libraries, rate books, and interact with other readers on the site. Also [...] users can supply their own tags for their books”. Data from this application are interesting because as Hjørland highlights, folksonomies assigned by users of social media (such as LibraryThing) present peoples' beliefs about the world and witness about “unfiltered representation of their living culture” (Hjørland 2018, 619).

Terms on PubMed are homogenous because they come from MeSH (controlled vocabulary) used to index contents on MEDLINE. They often start with a capital letter (*e.g.* “Education, Nursing”), while qualifiers names⁷ start with lowercase (Figure 2). Terms indicate concepts that may be stratified into two of eight Gnoli's dimensions of knowledge organization (Gnoli 2020): phenomena (*e.g.* “Stress Disorders”, “Universities”, “Smartphone”), and perspectives (“Education, Nursing”, “Follow-Up Studies”, “epidemiology”). These observations led us to notice that the terminology mediated by MeSH terms is entirely specialized and the manner of subject indexing is professional.

⁷On PubMed, qualifiers are used with descriptors and afford a means of grouping together those documents concerned with an aspect of a subject (a discipline, a scientific method, etc.) (National Library of Medicine 2015).

MeSH terms

- > Academic Performance / psychology
- > Adolescent
- > Adult
- > Anxiety / psychology
- > Cognition*
- > Depression / psychology
- > Female
- > Hostility
- > Humans
- > Male
- > Mental Health*
- > Middle Aged
- > Psychological Distress
- > Students / psychology*
- > Universities*
- > Young Adult

Figure 2 – An example of indexing on PubMed.

Tags assigned by users of LibraryThing are mostly heterogenous (non-controlled vocabulary): terms start sometimes by capital letters, sometimes by lowercases without any preconceived typographical rule (Figure 3). Concepts recalled by tags are phenomena (“suicide”, “youth”, “psychoactives”), disciplines (“nursing education”, “psychology”, “Mental health nursing”), documents (“e-bk, “textbook”, “non-fiction”) and collections (“Shelf 6”, “FHCS library”, “May”). The spectrum of knowledge organization dimensions is broader than on PubMed, which expresses uncontrolled and individualistic nature of tagging. The terminology transmitted by tags is generalist (simplest than on PubMed) and the manner of indexing is non-professional and non-coordinated.

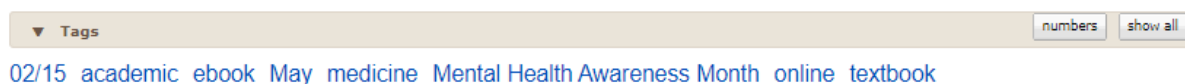


Figure 3 – An example of tagging on LibraryThing.

Representation of students' mental health in indexing terms

Semantic analysis of MeSH terms and tags used to index works on PubMed and on LibraryThing shows that students' mental health is an interdisciplinary subject studied by disciplines associated to medical and social sciences. Research methods, applied to study this phenomenon, are heterogeneous and include qualitative and quantitative methods, cross-sectional, multicenter, multivariate, self-reporting, and follow-up studies.

Students are stratified in four distinct age groups (childhood, adolescence, young adult age and adult age), highlighting the transition through different life periods. On PubMed, the human genre is always specified, followed by male and female ones, without any quantitative prevalence between two sexes. Transgenders and non-heterosexual subjects are not represented at all. A special focus is attached on students in college and in medical schools, because of a high exposure of this group to mental health issues. Key actors involved in student's mental health issues are health professionals (especially school nurses, and psychiatric and mental health nurses), parents, school staff, and social workers.

Recurrent student mental health disorders are depression, schizophrenia, substance-related disorders, addiction, ADHD, learning disabilities, psychological trauma, and burnout, while main behaviors include suicide, anxiety, stress, suicidal ideation, substance abuse and emotional problems. Student mental health is associated with social contexts experienced

during college and university, such as hostility, discrimination, stigma, stereotyping, violence, permissiveness, bullying, alcohol drinking and sexual activity.

Treatment and initiatives applied to manage these issues are mindfulness, self-help groups, self-care, cooperative behavior, counseling, psychotherapy, education, anti-drug propaganda, prevention and control. Digital tools (Internet, mobile applications, social media) may be sources of cyber aggression but may also be considered as help-seeking devices (telemedicine).

Types of places related to the student mental disorders are university, faculty, medical school, college, and workplace where students accomplish their internships. Anglophone territories, such as the USA, the UK, and Canada, are mostly represented on PubMed, while other countries are neglected.

Indexing terms on LibraryThing often refer to Mental Health Awareness Month, which shows that this initiative is known for a wider public.

A proposed organization of students' mental health-related knowledge

Gathered terms allowed us to propose a taxonomy sample *i.e.* a list of organized concepts by hierarchical relationships based on semantic similarity (Gnoli 2020, 77-78). Concepts were classified according to a top-down process of logical division, which split broader concepts into more specific ones (Gnoli 2020, 39).

108 collected terms have been finally chosen and uniformized (terms start with capital letters followed by lowercases) and alphabetically organized within facets (main classes). Proposed taxonomy was validated by a pediatrician, who is used to deal with mental health problems in children, adolescents, and young adults.

. Actors

- . .. Health professionals
- Nurses
- Psychiatric and mental health nurses
- School nurses
- Psychiatrists
- . .. Parents
- . .. School staff
- School counselors
- School psychologists
- Teachers
- . .. Social workers
- . .. Students
- By age group
- Adolescent
- Adult
- Child
- Young adult
- By genre
- Humans
- Female
- Male
- By occupational status
- College students
- Medical students

- Nursing students
- . **Digital tools**
- . .. Internet
- . .. Mobile applications
- . .. Social media
- . .. Telemedicine
- . **Disciplines**
- . .. Medical and health sciences
- Addictology
- Epidemiology
- Neurology
- Nursing
- Mental health nursing
- Psychiatric nursing
- Pediatrics
- Pharmacy
- Psychiatry
- Public health
- . .. Social sciences
- Anthropology
- Economics
- Education
- Psychology
- Counseling Psychology
- Psychometrics
- Social work
- . **Disturbing behaviors**
- . .. Anxiety
- . .. Emotional problems
- . .. Hostility
- . .. Stress
- . .. Substance abuse
- . .. Suicidal ideation
- . .. Suicide
- . **Experiences related to social context**
- . .. Alcohol drinking
- . .. Bullying
- Cyberbullying
- . .. Hostility
- . .. Permissiveness
- . .. Sexual activity
- . .. Social discrimination
- . .. Social stigma
- . .. Stereotyping
- . .. Violence
- . **Mental health disorders**
- . .. Addiction
- . .. ADHD
- . .. Burnout
- . .. Depression
- . .. Learning disabilities
- . .. Psychological trauma
- . .. Schizophrenia
- . .. Substance-related disorders

. Places

- . .. College
- . .. Faculty
- . .. Medical school
- . .. University
- . .. Workplace

. Research methods

- . .. Cross-sectional studies
- . .. Follow-up studies
- . .. Multicenter studies
- . .. Multivariate analysis
- . .. Qualitative research
- . .. Retrospective studies
- . .. Self-report
- . .. Statistics and numerical data
- . .. Surveys and questionnaires

. Treatment

- . .. Cooperative behavior
- . .. Counseling
- . .. Education
- . .. Help-seeking devices
- . .. Hospitalization
- . .. Mindfulness
- . .. Prevention and control
 - Anti-drug propaganda
 - Mental Health Awareness Month
- . .. Psychotherapy
- . .. Self-care
- . .. Self-help groups

Discussion and conclusion

The analysis of information resources and indexing terms highlights that students' mental health is a multidisciplinary domain and subject, invested by disciplines associated to medicine and social sciences. Students' mental health is investigated through an interdisciplinary approach, which invites to study this object beyond disciplinary boundaries. MeSH indexing terms used on PubMed represent specialistic terminology, are professionally used, and mediate scientific information, while tags on LibraryThing are made of non-specialistic terminology, are non-professionally assigned, and transmit mostly popularizing specialized contents.

The proposed taxonomy sample reveals the complexity of *real-life* situations and experiences to which students are confronted in their academic stage of life. Special attention is given to the nursing domain and professionals, revealing the importance attributed by specialized discourse to primary care actors and interventions in managing student mental health disorders.

Our taxonomy may also serve as a base to design or update MKOSs to organize and mediate knowledge on students' mental health.

This study has two main limitations. We analyzed two information sources only, that communicate specialized contents. This led us to neglect lay-public genres of discourse and to considerably narrow our field of investigation. Furthermore, we gathered a small sample of tags on LibraryThing, which did not allow us to compare them deeply with MeSH terms

from PubMed. Further investigations are therefore needed to obtain a richer and broader representation. Other types of social media, such as Facebook®, Twitter®, or Pinterest®, may probably be a richer source of data to better examine this phenomenon.

Finally, this work shows the equal engagement of information and documentation professionals, and users of social media in the mediation of knowledge dedicated to student's mental health. The significant rise in number of scientific publications over the last 15 years and the interest of wider public on this topic highlight that the awareness on the sensitive nature of students' mental health is increasing and expanding in our society.

Acknowledgment

I thank Dr Davide Paolo Caimmi (Centre Hospitalier Universitaire de Montpellier) for the final revision of the paper and for its work on validating the proposed taxonomy. I also thank Claudio Gnoli (Università di Pavia) for methodological advices. Finally, I thank Céline Paganelli (Université Paul Valéry, Montpellier 3) for her encouragement and full support for my participation to this colloquium.

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Number of characters:

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