BARRIERS AFFECTING THE ORAL HEALTH OF PEOPLE DIAGNOSED WITH DEPRESSION: A SYSTEMATIC REVIEW

Miloš STEPOVIĆ, Dalibor STAJIĆ, Zlata RAJKOVIĆ, Milena MARIČIĆ, Marija SEKULIĆ

1University of Kragujevac, Faculty of Medical Sciences, Svetozara Markovica 69, 34000 Kragujevac, Serbia
2University of Kragujevac, Faculty of Medical Sciences, Department of Hygiene and Ecology, Svetozara Markovica 69, 34000 Kragujevac, Serbia
3Academy for Applied Studies Belgrade, Department of School of Applied Health Science Studies, Belgrade, Serbia

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ABSTRACT

Keywords: depression, oral health services, oral health, barriers

Introduction: The problems of oral health of people diagnosed with depression are not adequately recognized, either in developed or developing countries. Social stigma, lack of self-interest, or even inadequate approaches of dental doctors towards the unique situation of this group of people this lead to excessive oral health problems.

Methods: The bibliographic database PubMed/Medline, Google Scholar, and Whiley online library were searched using the following text and MeSH as separate key terms and in combination: depression and oral health/dental caries/periodontal disease/tooth loss/utilization of oral health services/barriers. The content of documents was analysed using qualitative methodology.

Results: Twenty-six original studies were included in the review. Level/severity of depression, medication and medical comorbidity are the most important medical barriers influencing the oral health of people diagnosed with depression. Dental fear and anxiety are mostly combined with low oral hygiene and bad oral health. Socio-economic status, dental insurance, bad habits and education also have important roles in the oral health status of people diagnosed with depression.

Conclusion: Including individuals with depression and oral health problems in national health programs, creating specific prevention programs, or subsidizing the cost of treatment are some of the recommendations suggested as solutions.
1 INTRODUCTION

According to the World Health Organization, more than 300 million people of all ages are suffering from depression, but mainly people between 15 and 30 years, and this contributes in a significant way to the global disease burden (1, 2).

Depression is a mood disorder that may be caused by diverse internal and external factors: changes in brain chemistry, family history, or traumatic life experiences (3). This mood disorder is more than just a feeling of sadness, as it includes insomnia, weak concentration, and lost interest in everyday activities that could diminish concern for one's general and oral health. Moreover, depression is often linked with bad habits like eating disorders, smoking, and drug and alcohol abuse (4-6).

The bad oral hygiene in people with depression is linked with the fact that dental fear is more common in this group (7, 8). There are many studies showing that the level of oral hygiene is insufficient among people with depression, who thus have a higher rate of dental cavities compared to a general population. The inflammation of the gums caused by accumulated dental plaque can lead to problems like halitosis, periodontal disease development and eventually tooth loss (9). Antidepressants used in the treatment of this mental disorder may cause xerostomia, trouble in swallowing, bruxism, and an increase in the number of salivary lactobacilli, which causes tooth decay and consequent gum diseases (10). As such, keeping good oral health can improve the quality of life in people with depression, and also have a positive effect on the government budget and out-of-pocket health care spending (5).

The treatment of depression could be improved by investing more resources (11), and adopting an interdisciplinary approach to this condition (12, 13). However, data about barriers influencing the oral health of people with depression, and the possibilities for improvement, is still lacking (14-17). Existing systematic research papers and original research have reported on one or a few contributing factors of weak oral health status in depressed people (18, 19). However, most such studies are based on cross-sectional data giving information just on the current situation, and most do not follow the long-term expression of depression as a chronic illness (20, 21). In order to provide evidence for opportunities to improve oral health in patients with depression, the objective of the current study was to summarize the literature on barriers that could lead to an increase in pathological dental conditions of people in this group.

2 METHODOLOGY

2.1 Document Sources

The bibliographic database PubMed/Medline was searched using the following text and MeSH as separate key terms and in combination: depression and oral health/dental caries/periodontal disease/tooth loss/utilization of oral health services/and barriers (22). Google Scholar and Wiley online library were searched for more related articles (23, 24). All articles returned after every combination of keywords were reviewed, initially by abstract content and then if they were in line with the subject of this study they were included in the data.

2.2 Method of Document Identification and Assessing the Quality of Studies

The analyses of articles was done using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement checklist guidance and study flow diagram produced based on the PRISMA recommendations. We used a qualitative methodology, as this is highly recommended for systematic reviews, such as this one (25).

2.3 Methods of Inclusion/Exclusion of Documents

We included studies with a focus on a primary diagnosis of depression that also considering oral health conditions and barriers. Lifetime diagnoses and current diagnose of depression were both included. We considered studies on the adult population, and thus all participants in the included studies had to be 18 years and over, without any other psychiatric disorder. In the search strategy used with the online medical libraries, the following inclusion criteria were defined: clinical trials, abstracts and original articles (excluding review articles) available in full text, performed on humans, in the English language and not older than twenty years.

2.4 Content for Extraction

Information extracted from the original articles were references, country, year of the study, study design, age of the observed population, number of depressed participants, medical barriers, psychological barriers and other barriers.

3 RESULTS

3.1 Presentation of Observation Units

The search of PubMed returned 671 articles. This was carried out using a combination of different keywords with a Boolean operator for each word combination, as presented in the study flow diagram. By following the inclusion and exclusion criteria explained in the method section the number of articles fell to 135, and
after carefully examining the results all duplicates were removed. The final number of articles from the PubMed search was thus 13. The search of the Wiley online library and Google Scholar was performed, and an additional 13 articles were found. The final number of studies included in the research was thus 26.

Figure 1. Flowchart of the course of the selection of documents in the systematic review of the literature on barriers affecting the oral health of the people diagnosed with depression, following the PRISMA.

3.2 Characteristics of the Studies Included in the Systematic Review

We examined the year of research, population age, number of participants, and country where the research was conducted, along with barriers. For this research, we sorted the barriers that influence oral health in depressed people into three groups – medical, psychological and other (Table 1). Medical barriers are those affecting the oral health that are an integral part of depression: duration of the depressive episode, the clinical expression of depressive symptoms, the number of depressive episodes and number of hospitalizations, response to treatment, side effects of prescribed medications and observed comorbid somatic states. The psychological barriers are connected to the individual patient opinions, emotions and decisions: lack of self-esteem, dental fear, opinions about dental health, self-perceived general and oral health. The other barriers are the widest group, and include the socio-demographic and socio-economic characteristics as well as the physical barriers and habits of the individual, such as last dental check-up, possessing any kind of dental insurance, oral health habits, eating habits, smoking or drinking, education level, material and marital status, gender, cost of dental treatment, geographical availability of the service and similar.
Table 1. Selection of documents in a systematic review of the literature on barriers affecting oral health of people diagnosed with depression listed by reference, country, year of study, study design, age, number of participants, and observed barriers.

| Module name                | Country       | Year of study | Study design       | Age of the observed population | No. of depressed participants | Medical barriers                        | Psychological barriers                        | Other barriers                                                                 |
|----------------------------|---------------|---------------|--------------------|--------------------------------|-------------------------------|-----------------------------------------|---------------------------------------------|--------------------------------------------------------------------------------|
| Delgado-Angulo et al. (26) | Finland       | 2015          | cross-sectional study | 30 years and older            | 1,229                         | level/severity of depression /          | /                                           | consummation of sugar, number of tooth brushing, non-smokers, number of regular check-ups |
| Jin Park et al. (27)       | Korea         | 2014          | cross-sectional study | 19 years and older            | 6,139                         | level/severity of depression / self-perceived oral health / | /                                           | /                                                                              |
| Marques-Vida et al. (28)   | Portugal      | 2006          | cross-sectional average study | average age 21            | 388                           | level/severity of depression / anxiety / | /                                           | /                                                                              |
| Skośkiewicz-Malinowska et al. (29) | Poland | 2018          | cross-sectional over 65 years study | 500                     | level/severity of depression / / | socio-demographic                    | /                                           | /                                                                              |
| Houtjes et al. (30)        | Netherlands   | 2011          | cross-sectional study | 58 years and older            | 99                            | level/severity of depression / physical health, medication / self-perceived oral health / socio-economic characteristics | /                                           | /                                                                              |
| McFarland et al. (31)      | US            | 2010          | cross-sectional study | 19 years and older            | 399                           | level/severity of depression / self-efficacy / oral health behaviour | /                                           | /                                                                              |
| Heaton et al. (32)         | US            | 2013          | cross-sectional study | 21 years and older            | 2,024                         | / / /                                  | age, income, insurance                     | /                                                                              |
| Teng et al. (33)           | Taiwan        | 2016          | cross-sectional study | 18 years and older            | 7,625                         | / / /                                  | income, dental insurance                  | /                                                                              |
| Okoro et al. (34)          | US            | 2012          | cross-sectional study | 18 years and older            | 19,397                        | level/severity of depression /          | /                                           | /                                                                              |
| Pohjola et al. (35)        | Finnish       | 2011          | cross-sectional study | 30 years and older            | 644                           | / dental fear / socio-economic and socio-demographic | /                                           | /                                                                              |
| Persson et al. (36)        | Sweden        | 2010          | cohort study         | 18 years and older            | 10                            | / dental fear, low self-care /          | /                                           | /                                                                              |
| DiMatteo et al. (37)       | -             | 2000          | cohort study         | -                             | -                             | /                                       | noncompliance /                             | /                                                                              |
| Bernson et al. (38)        | Sweden        | 2012          | case-control study   | 18 years and older            | 404                           | /                                       | dental anxiety / socio-demographic          | /                                                                              |
| Hugo et al. (39)           | Brazil        | 2006          | cross-sectional study | 50 years and older            | 230                           | /                                       | lack of self-care, stress / bad oral habits | /                                                                              |
| Sasaki (40)                | Tokyo         | 2005          | case-control study   | average age 50                | 36                            | medication / lack of self-care /         | /                                           | /                                                                              |
| Yamamoto et al. (41)       | Japan         | 2017          | cohort study         | 65 years and older            | 872                           | /                                       | self-esteem /                              | /                                                                              |
| Anttila et al. (42)        | Finland       | 2006          | cohort study         | 31-32 years old               | 1,920                         | /                                       | self-perceived oral health / education, income, tooth brushing frequency / | /                                                                              |
| Hybels et al. (43)         | US            | 2015          | cohort study         | 65 years and older            | 944                           | level/severity of depression / self-perceived oral health / | /                                           | /                                                                              |
| Mago and Thyvalikakath (44) | Canada       | 2014          | cross-sectional study | 45 years and older            | 2,162                         | / / /                                  | age, marital status, education level, dental insurance, income / | /                                                                              |
| Adeniyi et al. (45)        | Nigeria       | 2011          | cross-sectional study | mean age 39.2                 | 105                           | / / /                                  | inadequate approach, income, socio-demographic / | /                                                                              |
4 DISCUSSION

4.1 Effects of Medical Barriers

Recent research on the oral health of people with depression showed that this group suffers from high levels of caries, periodontal disease and tooth loss. Due to the effects of depression, including lack of self-interest, applied medications, difficulty of accessing dental services, fear and inappropriate approach of dental doctors, dental caries and periodontal disease are the most frequent oral and dental diseases (19).

Depression severity is a very important factor and has a direct correlation with an increased number of dental caries. Delgado-Angulo found that adult depressed people had 25% more decayed teeth than non-depressed adults, and the highest incidence of dental caries was among depressed adults in the age group of 35-44 (69% more dental caries than non-depressed adults). Certain habits (less consumption of sugar, an average number of tooth brushings, not smoking) were at a satisfactory level in this group, but the number of regular dental check-ups should be higher and the amount of visible dental plaque should be lower (26). Jin Park et al. compared depressed people with a control group and showed that those with a lifetime diagnoses of depression brushed their teeth once or less a day (15.8%), had bad self-perceived oral health (52.3%), had a toothache more (31.5%) and a higher rate of periodontal bleeding (in both jaws) (27). Other research concluded that depressed respondents had higher odds of gum bleeding (4.96 times) (28).

There are many studies dealing with oral diseases among elderly depressed people. It is important to be note here that depression is not a condition that occurs among older people as an integral part of the aging process. However, depression in the elderly is usually followed by bad overall health and could also lead to serious damage to the oral system (high number of dental caries, more progressive periodontal disease and more tooth loss). Skośkiewicz-Malinowska et al. found that all depressed adults aged over 65 years had dental caries, and that as the severity of depression increased the number of missing and decayed teeth became larger (29). In Houtjes et al. most of the subjects were female (67%) and the major finding was that people with late-life depression had a higher percentage of unmet needs, which was explained by the impact of depression severity (30).

The study conducted by McFarland et al. concluded that the severity of depression had a significant impact on general oral health and oral health behaviour, with an average of 1.52 decayed teeth, 8.41 filled teeth and 3.23 extracted teeth, and the depressed subjects’ oral health was poorer than in non-depressed patients, while the frequency of brushing and flossing teeth was significantly lower (31). Additionally, mental illness contributes to the lower utilization of dental services, which is in correlation with the severity of depression. Other studies suggest that only 40% of people with mental illnesses visit dentists, among which the most regular visitors were patients with mood disorders, but they also were the group with the lowest utilization of dental services (32, 33). In Okoro et al. 24% of respondents had depression, 8% of them had current depression and 16% with lifelong depression, and the results shows that people with lifelong depression had a higher likelihood of having at least one tooth extracted, a1.38 times greater chance not visiting a dentist or having dental cleaning in the past few years in comparison with the control group (34). From a physiological perspective, sympathetic stimulation could also reduce the salivary flow and is observed as a part of the underlying mechanisms in depression.
pathophysiology. Additionally, the tricyclic antidepressant affects the salivary process by blocking parasympathetic stimulation of the salivary gland. Similar patterns were observed in some of the medications for the treatment of comorbid cardiovascular and metabolic diseases, and they could all lead to xerostomia and thus oral diseases. Anhedonia in depression also leads to the low oral hygiene and accumulation of dental plaque that causes caries and periodontal disease (20).

4.2 Effects of Psychological Barriers
A high association between excessive dental fear in patients with the diagnosis of depression was found in many types of research (35, 36). Moreover, depressed patients don’t visit a dentist regularly and have poor adherence to dental treatment due to their lack of self-care (37, 38). Root caries are a common localization of caries in older depressed patients and that could be explained not only by the insufficient amount of tooth brushing, but also by an inadequate tooth brushing technique due to a general lack of self-care (39, 40).

Lost and decayed teeth may cause problems with talking and chewing, and also affect the self-esteem of those with depression, which is already low, which are further contributing factors to social isolation, and Kisely et al. noted that all these factors eventually have an adverse impact on the life quality of patients with depression (21). Finally, having problems with smiling because of missing teeth as well as any other oral health problems may also reduce self-esteem and have effects on communications, which all may lead to worsening of depressive symptoms, especially in elderly people (41).

The association of dental health behaviour and self-perceived dental needs with depression were investigated in a population aged 31 and over (mild depression and depression summed to 22%), and symptoms of depression (mild symptoms), gender (female), education level (college degree) and family income (low) were associated with poorer frequency of teeth brushing and regularity of dental check-ups (42). Similar results were also found in a group aged 65 and older, which showed that even a moderate level of depression affects the self-perceived oral health of patients (health of the gum, decayed tooth, lost tooth, periodontal problems) (43).

4.3 Effects of Other Barriers
Mago et al. concluded that depressed patients had a 1.34 greater likelihood of never utilizing oral health services, especially males, in older age, widows/divorced, with post-secondary education, without dental insurance and with a self-perceived low income (44). Adeniyi et al. noted a high level of unmet dental needs in people with depression, identifying a potential problem in the oral health system with insufficient attention being paid to this group (45). Another study also found that about 25% of people with diagnosis of depression had unmet oral needs, with the main reasons being that 36.4% couldn’t get a dental appointment, 27.7% had some work/family responsibilities and 26.6% had transportation issues (46).

Using a different methodological approach, i Nguyen et al. reported that 62.6% of people who did regularly see dentists reported some problem with their teeth and gums (toothache, sensitive tooth, bleeding gum, missing tooth) in the previous six months, and about 54% of all examinees had some mental illness (including depression) (47). The same study found that 27% of people with depression did not have insurance that covers dental health needs, while they had a 1.6 times greater chance of having some acute dental needs (47). In Malecki et al. 47.7% of respondents did not have insurance that covers dental needs and 29.4% did not have any kind of insurance, with every indicator of poor oral health being higher as the depression severity progressed (48). The main reason for the high unmet dental needs in this group was the cost of dental care.

A recent study by Wiener et al. concluded that female gender, low income, education level under college degree, irregular dental visits and a large number of untreated crown dental carries are more likely to be associated with more severe symptoms of depression (49). Lifestyle and eating habits are also common variables that are examined in those studies where a connection between depression and oral health was found. Depressed people often smoke for comfort, as well as consume more sweets. Smoke reduces the salivary flow and the regular consumption of sweets can decrease pH in the mouth, thus increasing the chances of dental and oral diseases (50). If depression is unrecognized by healthcare professionals then this will result in a higher rate of dental diseases, as one of the many health issues that depression may lead to if it’s not prevented or/and adequately treated (51).

4.4 Limitations and Strengths of the Systematic Review
One limitation of this systematic review is the lack of standardized oral health indicators in the studies it examined (mostly expressed as the number of cavities, missing tooth or tooth with periodontal disease, rather than universal indexes) and insufficient comparison of the oral health status of people with depression between countries at different development levels. An additional limitation is that only some of the relevant bibliographic databases were searched.

Further research, and may also suggest some necessary improvements in health policy systems for the benefit of those with depression, or help in the development of special programs that will cover the specific needs of this group in a more effective way. It is also recommended that
a larger study with a longer follow-up period is conducted that collects information about the oral health status of this vulnerable category of people, which can then be used to drive better health care policies. Studies like this are currently lacking, but could lead to the creation of preventive programs for depressed individuals.

4.5 Importance of the Systematic Review for Oral Public Health
This systematic review has considerable public health importance because it presents a summation of the latest research in this area, and highlights the most important barriers that lead to inadequate or insufficient use of oral health care by people diagnosed with depression.

4.6 Possibilities for Future Research in the Field
This review article presents many possibilities and ideas for future research with regard to the oral health of people with depression, noting the preventability of the barriers that influence the oral health of this group. Using the standardized oral health indicators in future research would be helpful in collecting the numerical data that could be useful for a better comparison of results between countries, as well as inside countries, and these are two possibilities for future research.

5 CONCLUSION
It is important that most of the barriers affecting the oral health of people with depression be identified and then mitigated depending on their preventability. Many of the barriers identified in this study can be predicted and prevented through adequate and interdisciplinary and multidisciplinary approaches from both doctors and governments.

Raising the awareness of people with depression in the area of oral health through continuous education of such individuals, along with medical staff and doctors, would also result in a higher number of regular dental check-ups, which would consequently reduce the number of more radical and expensive dental treatments needed, and benefit the quality of the patients' lives overall.

The health care policies adopted by governments should be adapted for the specific needs of people with depression, including consideration of them in national programs for oral health or providing dental service benefits to reduce the costs. It should be the responsibility of every country, depending on the level of development and resources, to work towards reducing the burden of depression.

CONFLICTS OF INTEREST
The authors declare that no conflicts of interest exist.

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