

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

OVIRE, KI VPLIVAJO NA USTNO ZDRAVJE LJUDI Z DIAGNOZO DEPRESIJE: SISTEMATIČEN PREGLED

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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 Wiley 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/and 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.

IZVLEČEK

Ključne besede:

depresija, zobozdravstvene storitve, zdravje ustne votline, ovire

Uvod: Težave z ustnim zdravjem pri ljudeh z diagnozo depresije niso ustrezno prepoznane niti v razvitih državah niti v državah v razvoju. Družbena zaznamovanost, pomanjkanje zanimanja zase ali celo neustrezen pristop zobozdravnikov do edinstvene situacije pri tej skupini ljudi povzročajo čezmerne težave z zdravjem ustne votline.

Metode: Bibliografska podatkovna zbirka PubMed/Medline, Googlov učenjak in spletna knjižnica Wiley so bili preiskani z uporabo naslednjega besedila in izrazov MeSH kot ločenih ključnih izrazov in v kombinaciji: depresija in ustno zdravje/zobni karies/parodontalna bolezen/izguba zob/uporaba zobozdravstvenih storitev/in ovire. Vsebina dokumentov je bila analizirana s kvalitativno metodologijo.

Rezultati: V pregled je bilo vključenih 26 izvirnih študij. Stopnja/resnost depresije, zdravila in pridružene bolezni so najpomembnejše zdravstvene ovire, ki vplivajo na ustno zdravje ljudi z diagnozo depresije. Tesnoba in strah pred zobozdravstvenimi posegi sta večinoma povezana s slabo ustno higieno in slabim zdravjem ustne votline. Pri ustnem zdravju ljudi z diagnozo depresije imajo pomembno vlogo tudi socialno-ekonomski status, zobozdravstveno zavarovanje, slabe navade in izobrazba.

Sklep: Vključitev posameznikov z depresijo in težavami z ustnim zdravjem v nacionalne zdravstvene programe, oblikovanje posebnih preventivnih programov ali zagotavljanje ugodnejših cen storitev so nekatera priporočila, ki so bila predlagana kot rešitev.

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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 a 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 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 diagnosis 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 Whiley 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.

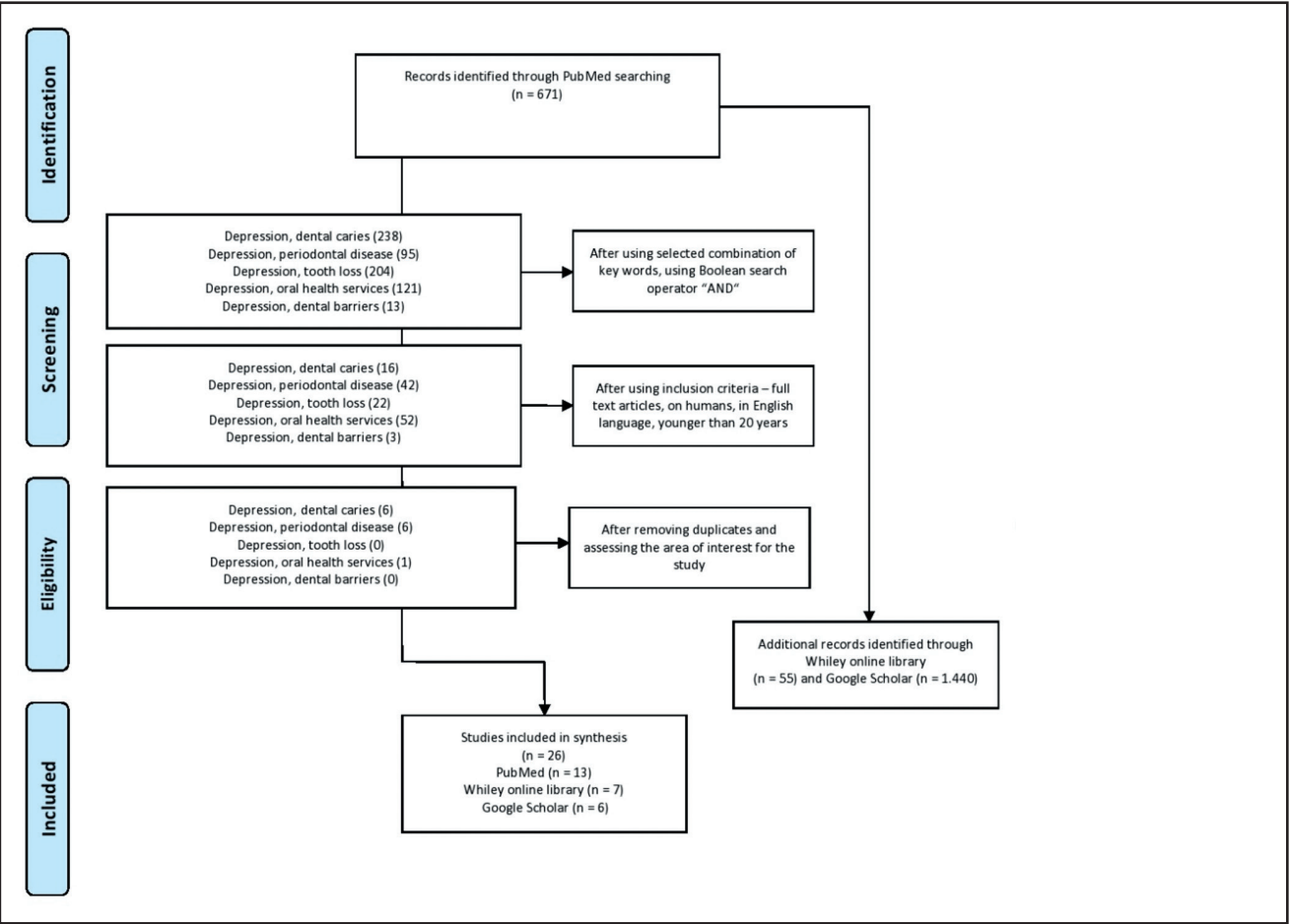


Figure 1. Flowchart of the course of the selection of documents in the systematic review of the literature on barriers affecting the oral health of the people diagnosed with depression, following the PRISMA.

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 the 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	/	consumption 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 study	average age 21	388	level/severity of depression	anxiety	/
Skośkiewicz-Malinowska et al. (29)	Poland	2018	cross-sectional study	over 65 years	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 of 39.2	105	/	/	inadequate approach, income, socio-demographic

Module name	Country	Year of the study	Study design	Age of the observed population	No. of depressed participants	Medical barriers	Psychological barriers	Other barriers
Shippee et al. (46)	Minnesota	2012	cross-sectional study	18 years and older	475	/	self-perceived oral health	appointment problems, work/family responsibilities, transportation, education
Nguyen et al. (47)	US	2018	cross-sectional study	18 years and older	1.778	general health / status	/	without insurance
Malecki et al. (48)	Wisconsin	2015	cross-sectional study	21 years and older	263	level/severity of depression	/	insurance, oral habits
Wiener et al. (49)	West Virginia	2018	cross-sectional study	21 years and older	2.374	/	/	socio-economic, socio-demographic, insurance, oral habits
Anttila et al. (50)	Finland	2001	case-control study	55 years	780	/	self-perceived oral health	smoking
Simon and Von Korff (51)	US	2006	cross-sectional study	Mean age of 50	439	medical comorbidity	/	/

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.

For 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 INTREST

The authors declare that no conflicts of interest exist.

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ETHICAL STATEMENT

Not required.

REFERENCES

1. World Health Organization, Geneva. Accessed on May 21th, 2019 at: <http://www.who.int/news-room/fact-sheets/detail/depression>.
2. Bachmann S. Epidemiology of suicide and the psychiatric perspective. *Int J Environ Res Public Health*. 2018;15(7).pii:E1425. doi: 10.3390/ijerph15071425.
3. Saveanu RV, Nemeroff CB. Etiology of depression: genetic and environmental factors. *Psychiatr Clin North Am*. 2012;35(1):51-71. doi: 10.1016/j.psc.2011.12.001.
4. Fried EI, Nesse RM. The impact of individual depressive symptoms on impairment of psychosocial functioning. *PLoS One*. 2014;9(2):e90311. doi: 10.1371/journal.pone.0090311.
5. Bergdahl M, Bergdahl J. Low unstimulated salivary flow and subjective oral dryness: association with medication, anxiety, depression, and stress. *J Dent Res*. 2000;79(9):1652-8. doi: 10.1177/00220345000790090301.
6. Rondina RC, Gorayeb R, Botelho C. Psychological characteristics associated with tobacco smoking behavior. *J Bras Pneumol*. 2007;33(5):592-601. doi: 10.1590/s1806-37132007000500016.
7. Lenk M, Berth H, Joraschky P, Petrowski K, Weidner K, Hannig C. Fear of dental treatment—an underrecognized symptom in people with impaired mental health. *Dtsch Arztebl Int*. 2013;110(31-32):517-522. doi: 10.3238/arztebl.2013.0517.
8. Yildirim TT, Dundar S, Bozoglan A, Karaman T, Dildes N, Acun Kaya F, et al. Is there a relation between dental anxiety, fear and general psychological status? *PeerJ*. 2017;15(5):e2978. doi: 10.7717/peerj.2978.
9. Kisely S, Quek LH, Pais J, Laloo R, Johnson NW, Lawrence D. Advanced dental disease in people with severe mental illness: systematic review and meta-analysis. *Br J Psychiatry*. 2011;199(3):187-193. doi: 10.1192/bjp.bp.110.081695.
10. Gholami N, Sabzvari BH, Razzaghi A, Salah S. Effect of stress, anxiety and depression on unstimulated salivary flow rate and xerostomia. *J Dent Res Dent Clin Dent Prospects*. 2017;11(4):247-252. doi: 10.15171/joddd.2017.043.
11. Möller HJ, Henkel V. What are the most effective diagnostic and therapeutic strategies for the management of depression in specialist care? Copenhagen, WHO Regional Office for Europe, 2005. Accessed on May 7, 2019 at: <http://www.euro.who.int/Document/E86602.pdf>.
12. Khan A, Faucett J, Lichtenberg P, Kirsch I, Brown WA. A systematic review of comparative efficacy of treatments and controls for depression. *PLoS ONE*. 2012;7(7):e41778. doi: 10.1371/journal.pone.0041778.
13. Hong SY. New frontiers in the continuum of dental education. *Prim Dent J*. 2018;7(2):44-9.

14. World Health Organization, Health systems, key components of well-functioning system. Accessed on May 27th, 2019 at: http://www.who.int/healthsystems/EN_hsskeycomponents.pdf.
15. Saekel R. Chinas oral care system in transition: lessons to be learned from Germany. *Int J Oral Sci.* 2010;2:158-176. doi: 10.4248/IJOS10054.
16. Nikolovska J. An analytic study of oral healthcare system in some EU countries. *Balk J Stom.* 2008;12:47-50.
17. Kandelman D, Arpin S, Baez RJ, Baehni PC, Petersen PE. Oral health care systems in developing and developed countries. *Periodontol* 2000. 2012;60(1):98-109. doi: 10.1111/j.1600-0757.2011.00427.x.
18. Tomar SL, Cohen LK. Attributes of an ideal oral healthcare system. *J Public Health Dent.* 2010;70(1):S6-S14. doi: <https://doi.org/10.1111/j.1752-7325.2010.00172.x>
19. Torales J, Barrios I, González I. Oral and dental health issues in people with mental disorders. *Medwave.* 2017;17(8):e7045. doi: 10.5867/medwave.2017.08.7045.
20. Boyapati L, Wang HL. The role of stress in periodontal disease and wound healing. *Periodontol* 2000. 2007;44:195-210. doi: 10.1111/j.1600-0757.2007.00211.x.
21. Kisely S, Sawyer E, Siskind D, Lalloo R. The oral health of people with anxiety and depressive disorders-a systematic review and meta-analysis. *J Affect Disord.* 2016;200:119-32. doi: 10.1016/j.jad.2016.04.040.
22. National Center for Biotechnology Information, Maryland. Accessed on Jul 1th, 2020 at <https://pubmed.ncbi.nlm.nih.gov/>
23. Google scholar. Accessed on Jul 1th, 2020 at <http://scholar.google.com/>
24. Wiley Online Library. Accessed on Jul 1th, 2020 at <https://onlinelibrary.wiley.com/>
25. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med.* 2009;6(7):e1000097. doi: 10.1371/journal.pmed.1000097.
26. Delgado-Angulo EK, Sabbah W, Suominen AL, Vehkalahti MM, Knuuttila M, Partonen T, et al. The association of depression and anxiety with dental caries and periodontal disease among Finnish adults. *Community Dent Oral Epidemiol.* 2015;43(6):540-9. doi: 10.1111/cdoe.12179.
27. Park SJ, Ko KD, Shin SI, Ha YJ, Kim GY, Kim HA. Association of oral health behaviors and status with depression: results from the Korean National Health and Nutrition Examination Survey, 2010. *J Public Health Dent.* 2014;74(2):127-38. doi: 10.1111/jphd.12036.
28. Marques-Vidal P, Milagre V. Are oral health status and care associated with anxiety and depression? a study of Portuguese health science students. *J Public Health Dent.* 2006;66(1):64-6. doi: 10.1111/j.1752-7325.2006.tb02553.x.
29. Skośkiewicz-Malinowska K, Malicka B, Ziętek M, Kaczmarek U. Oral health condition and occurrence of depression in the elderly. *Medicine (Baltimore).* 2018;97(41):e12490. doi: 10.1097/MD.00000000000012490.
30. Houtjes W, van Meijel B, Deeg DJH, Beekman AT. Unmet needs of outpatients with late-life depression; a comparison of patient, staff and carer perceptions. *J Affect Disord.* 2011;134(1-3):242-8. doi: 10.1016/j.jad.2011.05.052.
31. McFarland ML, Inglehart MR. Depression, self-efficacy, and oral health: an exploration. *OHDMBS.* 2010;9(4):214-222.
32. Heaton LJ, Mancl LA, Grembowski D, Armfield JM, Milgrom P. Unmet dental need in community dwelling adults with mental illness. *J Am Dent Assoc.* 2013;144(3):e16-e23.
33. Teng PR, Lin MJ, Yeh LL. Utilization of dental care among patients with severe mental illness: a study of a National Health Insurance database. *BMC Oral Health.* 2016;16(1):87. doi: 10.1186/s12903-016-0280-2.
34. Okoro CA, Strine TW, Eke PI, Dhingra SS, Balluz LS. The association between depression and anxiety and use of oral health services and tooth loss. *Community Dent Oral Epidemiol.* 2012;40(2):134-44. doi: 10.1111/j.1600-0528.2011.00637.x.
35. Pohjola V, Mattila AK, Joukamaa M, Lahti S. Anxiety and depressive disorders and dental fear among adults in Finland. *Eur J Oral Sci.* 2011;119(1):55-60. doi: 10.1111/j.1600-0722.2010.00795.x.
36. Persson K, Olin E, Östman M. Oral health problems and support as experienced by people with severe mental illness living in community-based subsidised housing - a qualitative study. *Health Soc Care Community.* 2010;18(5):529-36. doi: 10.1111/j.1365-2524.2010.00931.x.
37. DiMatteo MR, Lepper HS, Croghan TW. Depression is a risk factor for noncompliance with medical treatment: meta-analysis of the effects of anxiety and depression on patient adherence. *Arch Intern Med.* 2000;160(14):2101-7. doi: 10.1001/archinte.160.14.2101.
38. Bernson JM, Elfström ML, Hakeberg M. Dental coping strategies, general anxiety, and depression among adult patients with dental anxiety but with different dental-attendance patterns. *Eur J Oral Sci.* 2013;121(3 Pt 2):270-6. doi: 10.1111/eos.12039..
39. Hugo FN, Hilgert JB, Bozzetti MC, Bandeira DR, Gonçalves TR, Pawlowski J, et al. Chronic stress, depression, and cortisol levels as risk indicators of elevated plaque and gingivitis levels in individuals aged 50 years and older. *J Periodontol.* 2006;77(6):1008-14. doi: 10.1902/jop.2006.050037.
40. Sasaki E. Influence of tendencies toward depression, neurosis and psychosomatic disorders on oral symptoms. *Kokubyo Gakkai Zasshi.* 2005;72(4):235-46. doi: 10.5357/koubyou.72.235.
41. Yamamoto T, Aida J, Kondo K, Fuchida S, Tani Y, Saito M, et al. Oral health and incident depressive symptoms: jages project longitudinal study in older Japanese. *J Am Geriatr Soc.* 2017;65(5):1079-1084. doi: 10.1111/jgs.14777.
42. Anttila S, Knuuttila M, Ylöstalo P, Joukamaa M. Symptoms of depression and anxiety in relation to dental health behavior and self-perceived dental treatment need. *Eur J Oral Sci.* 2006;114(2):109-14. doi: 10.1111/j.1600-0722.2006.00334.x.
43. Hybels CF, Bennett JM, Landerman LR, Liang J, Plassman BL, Wu B. Trajectories of depressive symptoms and oral health outcomes in a community sample of older adults. *Int J Geriatr Psychiatry.* 2016;31(1):83-91. doi: 10.1002/gps.4292.
44. Mago A, Thyvalikakath TP. A population-based study of the impact of mood disorders on oral health-care utilization among middle aged and older adults in Canada. *Community Dent Oral Epidemiol.* 2014;42:451-9. doi: <https://doi.org/10.1111/cdoe.12102>.
45. Adeniyi AA, Ola BA, Edeh CE, Ogunbanjo BO, Adewuya AO. Dental status of patients with mental disorders in a Nigerian teaching hospital: a preliminary survey. *Spec Care Dentist.* 2011;31(4):134-7. doi: 10.1111/j.1754-4505.2011.00193.x.
46. Shippee ND, Thiede Call K, Weber W, Beebe TJ. Depression, access barriers, and their combined associations with unmet health needs among publicly insured individuals in Minnesota. *BMC Health Serv Res.* 2014;14:62. doi: 10.1186/1472-6963-14-62.
47. Nguyen H, Lin SC, Cappelli DP, Nair S. The association between dental, general, and mental health status among underserved and vulnerable populations served at health centers in the US. *J Public Health Dent.* 2018;78(1):41-48. doi: 10.1111/jphd.12234.
48. Malecki K, Wisk LE, Walsh M, McWilliams C, Eggers S, Olson M. Oral health equity and unmet dental care needs in a population-based sample: findings from the survey of the health of Wisconsin. *Am J Public Health.* 2015;105(3):S466-74. doi: 10.2105/AJPH.2014.302338.
49. Wiener RC, Shen C, Findley PA, Dwivedi N, Sambamoorthi U. Depressive symptoms and untreated coronal dental caries among adults ages 21-64 years, NHANES 2013-2014. *Community Dent Health.* 2018;35(3):179-185. doi: 10.1922/CDH_4304Weiner07.
50. Anttila SS, Knuuttila ML, Sakki TK. Relationship of depressive symptoms to edentulousness, dental health, and dental health behavior. *Acta Odontol Scand.* 2001;59(6):406-12. doi: 10.1080/000163501317153275.
51. Simon GE, Von Korff M. Medical co-morbidity and validity of DSM-IV depression criteria. *Psychol Med.* 2006;36(1):27-36. doi: 10.1017/S0033291705006136.