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**REVIEW ARTICLE**

# A Narrative Review of the Prevalence of Periodontitis in Saudi Arabia: A Proposal for a National Oral Health Research Agenda for Vision 2030

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**Abstract:**

***Objective:***

The objective of this narrative review is to summarize the current knowledge on the prevalence of periodontitis in the Kingdom of Saudi Arabia (KSA) and to make recommendations for monitoring and improving oral health in the KSA population.

***Background:***

Periodontitis is a significant health issue in the general population, so conducting routine public health surveillance for this condition is important in every country. KSA is currently implementing a strategic plan called Vision 2030 which aims to improve many of the country's infrastructures, including healthcare.

***Methods:***

To conduct this narrative review, Google Scholar (GS) was used to search for peer-reviewed articles on the prevalence of periodontitis in KSA. No limits were placed on the year of publication, but only articles translated into English were considered. Search terms used included "Saudi Arabia", "periodontitis", "surveillance", "prevalence", "rates", "oral health" and "dental".

***Results:***

The earliest estimate identified was from 1992, in which the rate of lack of periodontal health was estimated to be 90% in KSA residents aged 25 and over. A more recent estimate reported rates around 50%, but used a different case definition. Studies on tobacco use, periodontal health and KSA established that how tobacco is used strongly influences periodontal status. Other dental studies in KSA focus on other topics. The Saudi Health Information Survey (SHIS) conducted in 2013 asked oral health questions, but did not seek to estimate the rates of periodontitis in KSA.

***Conclusion:***

The World Health Organization's (WHO) recommendations suggest that KSA should conduct research to develop surveillance case definitions of periodontitis that will have specific utility in KSA, and can be standardized to compare KSA rates with the rates worldwide. The existing surveillance definitions and efforts in other countries have been considered less than optimal, so research is needed to inform KSA's effort. Recommendations are made for a national oral health research agenda in KSA under Vision 2030.

**Keywords:** Prevalence, Periodontitis, Saudi Arabia, Oral health, Gum disease, Dental studies.

## 1. INTRODUCTION

Periodontitis, informally referred to as "gum disease", has been defined as a chronic inflammatory disease of the periodontium [1]. In its advanced form, there is a loss of the perio-

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dontal ligament, and the destruction of the surrounding bone [1]. Chronic periodontitis generally affects adults, while aggressive periodontitis can affect both adults and children [2]. Worldwide, it is the main cause of tooth loss and considered a significant threat to oral health [1]. It is estimated to affect 20 to 50% of the global population [1].

Periodontitis is not only a significant health problem in the general population, but higher rates are seen in individuals with

particular risk factors. Smoking is an important risk factor for periodontitis [3], as is diabetes status and poor oral health self-care [1]. There are other evidence-based modifiable and non-modifiable risk factors for periodontitis that have been identified globally [1].

Typically, countries track both oral health status and risk factors for periodontitis as part of the country's public health surveillance system. In the United States (US), the Behavioral Risk Factor Surveillance System (BRFSS), a cross-sectional phone survey conducted with over 400,000 people in the US every year, includes questions about oral health status and oral health care use [4]. Also in the US, another cross-sectional annual surveillance effort takes place called the National Health and Nutrition Examination Survey (NHANES) [5]. In the NHANES, individuals are asked questions about health conditions including oral health, and then undergo several different physical examinations, including an oral health examination. The World Health Organization (WHO) has arranged oral health surveillance in different countries in Africa, although Niger and Senegal conduct regular oral health surveillance themselves [6]. China and Thailand in Asia have also conducted regular surveys of oral health in the population and linked that to health promotion efforts [6].

However, measuring periodontitis as part of a surveillance effort is not without challenges. Over the course of the BRFSS and the NHANES, many changes have taken place with the case definition of periodontitis in an effort to develop an optimal one [7]. Even more recently used definitions are thought to be inaccurate and produce an underestimate [8]. For the BRFSS, there still remains indecision as to whether or not periodontitis or "gum disease" would be accurately reported in a phone survey [9].

The utility of any case definition is predicated upon which population was used to develop the case definition. This is recognized in the WHO's surveillance tools designed to assist countries with developing their oral health surveillance systems [6]. They recommend a STEP wise approach to surveillance (STEPS), which involves beginning with developing or adopting case definitions for conditions subject to the sur-veillance [6]. Therefore, each country will need to adapt US methods or develop their own methods in order to accurately monitor periodontitis and risk factor rates. It follows, then, that an acceptable body of scientific research published in peer-reviewed articles about evidence-based case definitions of periodontitis that pertain to a specific country's population must exist before an evidence-based case definition for the country can be proposed.

The Kingdom of Saudi Arabia (KSA) has been actively expanding and modernizing its healthcare system to ensure access to care for all citizens [10]. The core of the KSA healthcare system is formed through many Ministry of Health (MoH) public facilities that are associated with academic institutions [10]. These services form expansive, technological "medical cities" in urban areas [10]. Though these medical cities provide state-of-the-art care, there can be access issues in non-urban areas, so KSA is working to integrate more primary healthcare centers into the system to serve individuals in these areas [10].

Both the urban centers and the primary healthcare centers in KSA may offer dental services [11]. In addition, businesses providing private healthcare services of all types are being encouraged by the KSA government through the National Transformation Plan (NTP) 2020 and the new national strategic plan for KSA, Vision 2030 [12, 13]. Vision 2030 provides the opportunity to create supplemental healthcare services to support the growth of the public sector to enhance the efficiency of the existing infrastructure [12, 13]. In dentistry, this is being seen in the proliferation of private dental clinics to supplement access to public services already provided through the MoH [14].

However, currently, KSA has no routine national public health surveillance system, and although some studies have been conducted, there is no current overall picture of the state of periodontal health in KSA [15]. This is unfortunate, because there are signals from the best evidence-based studies in KSA that suggest the population-based prevalence of periodontitis may be high [16, 17]. In order to develop an accurate picture of the state of periodontal health in KSA, evidence-based studies will need to be conducted, and these will benefit from the existing literature, though it is incomplete. However, it will be difficult for those studies to benefit from the results available because these have not been assembled up to now into a review. Hence, the aim of this narrative review is to summarize the current knowledge on the prevalence of periodontitis in KSA, and to make recommendations for a national oral health research agenda for developing an infrastructure to effectively monitor and improve oral health in the KSA population.

## 2. MATERIALS AND METHODS

Because there were few studies conducted on this topic, a systematic literature review was not possible, so a traditional or "narrative" literature review was used, which is appropriate when studies on the topic are lacking [18, 19]. In their landmark paper, Collins and Fauser encourage scientific writers to choose wisely when selecting whether to do a narra-tive review compared to a systematic review [18]. They acknowledge the scientific strengths of the systematic review study design, but then emphatically point out that systematic review methodology may be inadequate at best and harmful at worst to apply to some topics [18]. One example they cite constituting a case where choosing a systematic review instead of a narrative review would be a weakness rather than a strength is the case of a historical review, which they describe as an "irreplaceable means of tracing the development of a clinical concept, and]the narrative thread could be lost in the strict rules of syste-matic review" [18]. These strict rules would include specifying inclusion and exclusion criteria for articles included in the review, while a narrative review does not seek to include all the articles on a topic, and allows for selecting articles based on their relevance to the topic [18].

For this narrative review, Google Scholar (GS) was used to search for peer-reviewed articles on the prevalence of perio-dontitis in KSA. Studies have shown that GS covers more literature than traditional scientific databases, and could be used solely for a systematic review [20, 21]. No limits were placed on the year of publication. Search terms used included "Saudi Arabia", "periodontitis", "surveillance", "prevalence",

"rates", "oral health" and "dental". Only articles that provided an English translation were considered.

## 3. RESULTS

Prior to 2005, very few studies exist that attempt to estimate the rates of periodontitis in KSA samples. In 1992, Guile used cluster sampling to study adults in community households in Riyadh [17]. Guile did not use a working definition of periodontal disease; rather, he defined participants who did not exhibit bleeding, calculus, or shallow or deep pockets as orally "healthy" [17]. In all age groups over age 25, the prevalence of not being orally "healthy" was 90% or greater, and the unadjusted prevalence in the study of not being orally "healthy" was approximately 84% [17]. The take-home message from this study was that had the researcher measured the rates of periodontitis in these subgroups using a more accurate case definition, the result would have likely been high, meaning probably greater than 50%.

Between this article of 1992 and now, studies in KSA generally have not focused on estimating prevalence rates, but have instead studied issues surrounding high-risk groups [22], as well as the prevention and treatment of oral health conditions [23]. Up till now, KSA has not established a routine oral health surveillance system, but in 2013, a cross-sectional survey on the KSA population was carried out which included some questions regarding oral health [15]. Recent prevalence studies have focused only on clinical populations, not on population-based rates [11, 24, 25]. This section summarizes what is known in terms of population-based rates of periodontitis and other oral health characteristics in the KSA population.

### 3.1. Tobacco Use and Prevalence Estimates of Periodontitis in KSA

Obviously, the use of the case definition of "healthy" poses challenges when trying to compare the results of this study with the rest of the scientific literature. In 2005, Natto published a report from the Karolinska Institute which sought to quantify the impact of different patterns of tobacco use in KSA (water pipe, cigarette, or both) and correlate these with patterns of oral health [16]. While the focus of the report was correlating oral health metrics with tobacco use metrics, at one point in the report, the authors defined periodontal disease as having a bone height of 70% or less as determined by the radiograph [16]. Using this definition, the authors calculated the prevalence of periodontal disease stratified by age group ranging from 5% to 50% depending on age and smoking status [16]. While this thesis is by no means a definitive study reporting prevalence rates of periodontal disease in KSA in 2005, it provides a starting point for analysis. It also demon-strates that the known risk factor for periodontitis of tobacco use must be measured accurately in this population because the nature of tobacco use varies person to person due to cultural influences [16].

### 3.2. Other Studies of Periodontitis in KSA

Other studies in the KSA that relate to periodontal health have not been able to provide population-based estimates. Many have been focused on particular hypotheses or subpo-pulations, such as one case-control study seeking to correlate low birthweight of infants with the mother's periodontal status [26]. In the KSA, a traditional way of cleaning the teeth is to use a *miswak*, which is a branch from the arak tree that has a brushlike end that can be used to polish teeth [27]. A study in 1991 found that *miswak* use by individuals in the KSA was associated with a lower need for periodontal treatment, but rates of periodontitis were not quantified [27]. Other studies in the KSA have focused on improving dental care for various subpopulations [28, 29].

The estimates of poor periodontal health put forth in the thesis by Natto and the early study by Guile have not been supplanted by new numbers from more recent studies. Newer studies have been focused on the relationship of risk factors to periodontal disease rather than rates of periodontal disease. Tobacco use [30], co-morbidities such as diabetes [22], oral hygiene practices [23], and studies in children [31] dominate the KSA dental literature, but there is a distinct lack of descriptive studies estimating the rates of oral health conditions in the population. In 2018, for example, at least three studies were published about the clinical prevalence of periodontitis in various regions of the KSA, but none provided a valid, population-based prevalence estimate [11, 24, 25].

### 3.3. The Saudi Health Information Survey (SHIS)

The Saudi Health Interview Survey (SHIS) took place in 2013 and represented the first national effort to conduct chronic disease risk factor surveillance in the KSA [15]. Researchers from the University of Washington designed the system under the direction of the KSA Ministry of Health (MoH) [15]. In the cross-sectional study, researchers sampled members of KSA households and conducted a survey, then asked these individuals to present at a clinic for laboratory analysis [15]. The response rate from the household survey was 89.4%, but only 52.1% followed up with laboratory screening [32].

In their report on SHIS methods and results, the researchers provided documentation of the questions asked in the survey [15]. These are reprinted in Table **1**.

After collecting the data in 2013, the authors continued to analyze the same dataset, and produced many papers including the ones on topics associated with various chronic diseases. They also presented the results associated with the above questions in a paper on dental clinic utilization and oral hygiene practices [33]. Their results showed that regardless of smoking status, about 10% of the population went for a routine dental check-up in the previous year, and about 50% of the population visited a dental clinic for a complaint in the previous year [33]. Also, they found that a large proportion of the population that did not routinely utilize dental care also had poor oral health self-care practices, such as never using a toothbrush, dental floss, or *miswak* [33].

## 4. DISCUSSION

This narrative literature review demonstrates that there are no current, accurate population-based estimates of the rate of periodontitis in the KSA population. The evidence available

suggests that the rates of oral health conditions are high, with a prevalent and important risk factor in the KSA population for poor oral health being various patterns of tobacco use, while dental care is utilized moderately by the population, oral self-care is lacking. However, these findings are very general and must be interpreted without a solid evidence base due to the lack of high-quality studies in this area in the KSA.

### 4.1. Comparison with Other Surveillance Efforts

Although the SHIS included a representative sample of over 10,000 KSA residents and therefore produced useful results on many health topics, the way the oral health questions were structured could not shed light on the prevalence of periodontitis [33]. The questions and answers were worded in such a way that measurement could be compromised. The answers were provided in a "per day" timing framework; those who might brush or floss a few days "per week" were not able to answer that way (Table **1**). The questions bore little resemblance to the questions from the BRFSS, which are presented in Table **2** [34].

**Table 1. Oral health questions from the Saudi Health Information Survey.**

| Question | Answer Choices |
|---|---|
| During the past 12 months how many times did you visit a dental clinic for a check-up (without any dental problem)? | Never=0<br>Once=1<br>More than once=2<br>Don't know=77<br>Decline to respond=88 |
| During the past 12 months how many times did you visit a dental clinic for a dental complaint? | Never=0<br>Once=1<br>More than once=2<br>Don't know=77<br>Decline to respond=88 |
| How many times do you brush your teeth using a brush and tooth paste? | Twice a day, or more=3<br>Once a day=2<br>Less than once a day=1<br>Never=0 |
| How many times per day do you floss your teeth? | Don't floss=0<br>Less than once per day=1<br>Once per day=2<br>2 or more times per day=3<br>Don't know=77<br>Refuse to respond=88 |
| How many times do you use Miswak to clean your teeth? | Twice a day, or more=3<br>Once a day=2<br>Less than once a day=1<br>Never=0 |

While the BRFSS is a phone survey, the NHANES not only includes surveys but an oral health examination, which was apparently outside the scope of the SHIS [35]. In any case, if another wave of the SHIS is ever conducted, it should include an oral health component that measures periodontal health in some way. If this comes in the form of self-report, studies should be carried out to develop highly sensitive and specific questions to ask from the residents of KSA.

**Table 2. Oral health questions from the 2018 Behavioral Risk Factor Surveillance System.**

| Survey | Question | Answer Choices |
|---|---|---|
| 2018 BRFSS | Including all types of dentists, such as orthodontists, oral surgeons, and all other dental specialists, as well as dental hygienists, how long has it been since you last visited a dentist or a dental clinic for any reason? | Read if necessary:<br>1. Within the past year (anytime less than 12 months ago)<br>2. Within the past 2 years (1 year but less than 2 years ago)<br>3. Within the past 5 years (2 years but less than 5 years ago)<br>4. 5 or more years ago<br>Do not read:<br>7. Don't know / Not sure<br>8. Never<br>9. Refused |
| 2018 BRFSS | Not including teeth lost for injury or orthodontics, how many of your permanent teeth have been removed because of tooth decay or gum disease? | Read if necessary:<br>1. 1 to 5<br>2. 6 or more but not all<br>3. All<br>8. None<br>Do not read:<br>7. Don't know / Not sure<br>9. Refused |

But if the future waves of the SHIS include an oral exam, studies should be carried out prior to this to develop a more robust surveillance case definition. The case definitions used in the two previous studies in KSA reviewed were not adequate for modern periodontitis surveillance [16, 17]. However, the current case definition used by NHANES is controversial and has also been considered inaccurate [36]. Therefore, if an oral health examination component is envisioned in KSA risk factor surveillance, studies should be conducted in KSA to develop an examination case definition with adequate sensitivity and specificity for periodontitis in the KSA population.

### 4.2. National Oral Health Research Agenda

It became evident in this narrative review that many KSA researchers are interested in improving oral health and oral health care in the KSA population through their studies, but without a national oral health research agenda (as proposed in Fig. (**1**)), it is hard to integrate the findings from these studies so they can point in the direction of health policy.

As shown on the left side of Fig. (**1**), it is clear that high-quality, routine surveillance studies are needed to accurately estimate rates of not only oral health conditions but risk factors for them in the KSA population. These should be coordinated by the MoH so that the results can directly inform MoH policy. These should be coordinated by the MoH so that the results can directly inform MoH policy.
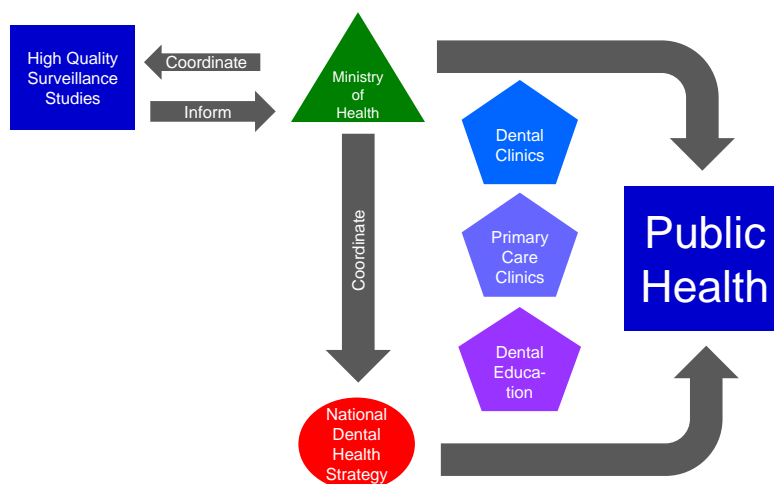
**Fig. (1).** Proposal for a national oral health research agenda.

Next, the MoH will need to actively calibrate how the dental healthcare system grows under Vision 2030 in order to ensure the availability of public and private services to the population. This will require health services research to be paired up with surveillance of risk factors and disease. The aims of this body of research will also be to consider healthcare delivery settings, such as primary care clinics and dental clinics, as shown in Fig. (**1**). Ultimately, this will also lead to better public health practice. For example, oral public health services could be delivered to children in a school-based setting, while adults could receive oral health preventive care and education in workplaces.

In addition to monitoring both oral health in the population and oral health services access, the national oral health research agenda should include quantifying and intervening on preva-lent risk factors for periodontitis, such as tobacco use, which again calls upon both primary care and dental care cli-nics for support in promoting public health (Fig. **1**). Actually imple-menting smoking cessation programs in dental clinics has been proposed and studied, and should be considered as a possible preventive intervention in the KSA [37, 38]. Further, once surveillance identifies high-risk groups, specific treatment and prevention studies could be carried out on those groups, which again would be coordinated by MoH.

Finally, as shown in Fig. (**1**), it appears that studies of dental education should be included in the national oral health research agenda for KSA. The healthcare system in KSA is expanding, and the workforce is expanding with it, leading to greater evolution and development of higher education for healthcare workers in all fields including dentistry and dental education [39]. Having the MoH coordinating the oral health research agenda while continuing to coordinate overall public health and health policy in the KSA would result in the optimal balance of all these entities.

## CONCLUSION

In conclusion, this narrative review shows that the current knowledge on the prevalence of periodontitis and risk factors for periodontitis in the KSA is lacking. However, if we imple-ment a national oral health research agenda under Vision 2030, we can address this gap. KSA oral health researchers will need to take the lead in developing validated case definitions for oral health surveillance, as well as work on creating self-report

questions about oral health that are valid and reliable and can be used on surveys. The MoH will need to take the lead in ensuring nationwide surveillance and monitoring oral health-care access, oral health conditions, and risk factors. Education and private industry will have to work with the government to ensure the perfect balance between dental education, private and public dental services, and oral public health through community dentistry in the population. If leaders in oral healthcare and oral health research in the KSA work together, we can not only accurately quantify our rates of oral disease and risk factors, but we can actively intervene on them to improve the entire nation's oral health.

## AVAILABILITY OF DATA AND MATERIAL

Not applicable.

## CONSENT FOR PUBLICATION

Not applicable.

## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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