



POPULATION AND ORAL HEALTH

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ABSTRACT

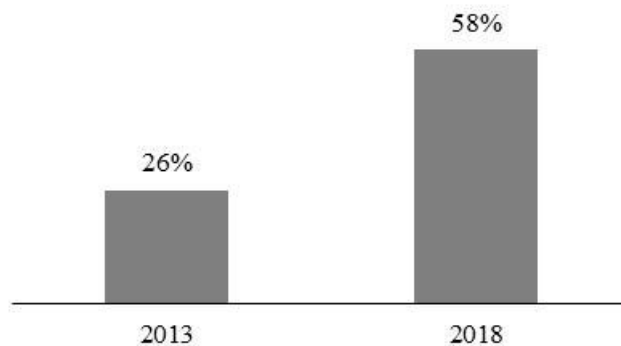
Oral and dental health is strongly related to population and society in human history based on archaeological evidence. There is a growing concern toward oral and dental health which relates not only to an individual but also population, as oral and dental health nowadays is sought as an essential factor in determining life quality. The dynamic of oral and dental health is related to biological and cultural factors. Yet, these factors are predisposed by the socioeconomic and demographic situation, diet patterns, technology advancement, as well as globalization. Moreover, amongst those factors, human behavior is the main attribute toward oral and dental health status. The era of the aging population is to be the next challenge for better oral and dental health status in the future.

Keywords: Population and society, oral and dental, health

INTRODUCTION

Oral diseases have existed since the age of mankind and perhaps long before the existence of civilization. There are some archaeological findings from which showed evidence of caries and periodontal diseases in humans (Stoy, 1951; Tanga et al., 2020). Another finding referring to ancient Egypt's population showed patterns of oral diseases, which are similar regardless of socioeconomic characteristics in

the former period, yet gradually this pattern altered and became distinct by socioeconomic characteristics in the latter period (Forshaw, 2009). Ancient civilizations such as Egypt, Babylonian, and Rome also discovered ancient methods of treating dental and oral diseases by using herbals and other natural sources as well as seeking dental and healthcare (Stoy, 1951; Gismondi et.al, 2020; Tanga et al., 2020).



Source: RISKESDAS 2013 and 2018

Graph 1. The proportion of Indonesians who had oral and dental problems within 12 months before the survey 2013 and 2018

Nowadays, oral diseases are more complex. Yet, the perspective of oral diseases has altered, as it is not only sought as an individual problem but also as a community matter. Moreover, there is a growing concern regarding the trend of oral problems. In Indonesia as an example, Indonesia Basic Health Research (RISKESDAS) reported that within five years the proportion of oral problems in Indonesia increases from 26% to 58% in 2013 and 2018 respectively (RISKESDAS, 2013 2018). Whereas it is also stated the largest proportion who suffer oral problems are from lower socioeconomic backgrounds (Graph 1). Yet, this group is also more susceptible to untreated oral diseases due to limited access to oral health treatment (Akbar, 2019). Indeed, it creates an oral health gap between socioeconomic stratification. However, to some extent, socioeconomic factors are not as strongly related to oral health

inequality as cultural/ethnic factors (Lee & Divaris, 2014). Baelum (2011) argued that oral and dental diseases are mainly caused by human behavior factors. These factors, however, mirror cultural norms as established and shaped by society and socioeconomic perspective. Thus, the effect of individual traits on oral and dental health becomes insignificant due to the influence of society and socioeconomic factors. These are examples of how population affects oral health and vice versa. Therefore, this article will examine the relationship between population and oral health from ancient to the contemporary era, from both population and oral health perspectives.

DISCUSSION

Demographic transition and oral health

The prevalence of oral and dental diseases is affected by two major factors as biological and cultural factors. Microbial flora and host

defense mechanism are classified as the former, whilst dietary habits, nutrition intake, and food production methods are classified as the latter (Zhang et al, 2010). Civilization shifting, which triggered demographic transition, also affects oral and dental diseases. Civilization shifts alter both biological and cultural factors.

Brothwell (1959) and Stoy (1951) mentioned some archaeological evidence regarding oral and dental diseases since the ancient times of mankind, not only from the post-stone age but also when humans as *Homo sapiens* lived together with other extinct *Hominidae* species as far as 500,000 years ago. These diseases are related to the harsh environment and malnutrition due to food competition between *Hominidae* species.

The demographic transition seems to be related to oral and dental health. During Neolithic period, which is known as the period of hunting, fishing, and gathering, is also characterized by the increase of the general population. Yet, in this period the prevalence of caries decreased and the incidence continued to decrease with the development of technology, agriculture, social structure, and economy in the society as well as the increase of population and town development (Brothwell, 1959; Adler et al., 2013).

Watson et al (2010) emphasized the gap in the prevalence of oral and dental disease due to the Neolithic demographic transition. Neolithic demographic transition is also responsible for the gap of dental caries and periodontal disease between men and women within the same period. Watson and colleagues' study (2010) related their findings of oral and dental disease not solely with diet patterns but also with women's reproductive health. Some physiological changes during pregnancy are responsible for changing the oral environment and the level of bone mineral density. The combination between those physiological changes and high starch intake caused the greater risk of suffering from dental caries and periodontal disease among women.

Archaeological evidence showed the decrease of caries prevalence during the Neolithic period to the Bronze Age in Britain, Greece, France,

and Taiwan. This suggests a low carbohydrate or less sugary diet pattern or less cariogenic food sources within this period (Brothwell, 1959; Pietruszewski et al., 2013).

During the Bronze Age, the population grew larger, as a result of the agricultural age. In return, it followed with migration to seek a better settlement to grow crops. As the food source became starchier, the risk of caries was also high. Consequently, the caries prevalence from Bronze Age to Iron Age increased. In a few civilizations such as the British, Greek, and Yayoi people in Japan, caries prevalence even increased dramatically within those regions. (Brothwell, 1959; Watson et al., 2010; Hamasaki & Takehara, 2012). Another evidence showed the prevalence of tooth loss during the same periods within British and Greek populations and deteriorating oral health in the Cambodian population (Brothwell, 1959; Watson et al., 2010; Newton et al., 2013).

Egyptian mummies provided evidence to examine oral and dental diseases within their long-range empire period. The prevalence of caries in ancient Egypt was rare compared to Egypt as one of the Roman Empire's provinces. Similarly in ancient Britons, the prevalence of caries increased dramatically after Roman dominated the country. On the other hand, societies that lived far from civilization for instance the Eskimos, the New Zealand Maoris, and the South African Bantus had almost perfect teeth. However, the dental disease increased sharply since the white men occupied those countries (Stoy, 1951; Forshaw, 2009; Zakrzewski, 2012).

Civilization changed the diet pattern which may have affected general health and manifested in oral and dental health, or only affected oral dental health as the point of contact between body and food. For instance, sugar consumption stimulated the acidity of oral and resulting dental caries, while the consumption of refined flour reduced calcium intake which is necessary to protect the enamel from dental decay (Stoy, 1951; Forshaw, 2009; Zakrzewski, 2012). The impact of transition from food gathering period to agricultural period on women's oral and dental health are

more significant than men's. During that period, the dental caries rate increased significantly, the tooth loss rate amongst women was higher than men but the caries rate was the same (Stoy, 1951; Watson et al., 2010; Zhang et al., 2010).

A study from Papas et al (1989) explained the mechanism of oral and dental disease due to the change of dietary habits. Papas et al categorized the type of food based on its risk in resulting caries. The starchy food diet pattern, which is considered a moderate cariogenic diet, increased the susceptibility of dental caries. The non-cariogenic food, such as fish, animal products, fruits, and vegetables contained essential substances to protect oral and dental tissue from diseases.

Preventing oral and dental diseases in ancient civilization

The attempt to overcome oral and dental diseases has also been carried out since ancient times. People had already realized that maintaining oral hygiene is necessary to prevent oral and dental diseases. Religion also has an important role regarding this matter (Stuart, 1997; Forshaw, 2009; Blomstedt, 2013; Gupta et al., 2015).

Generally, people are more concerned about oral malodor. Halitosis or bad breath as the result of lack of oral hygiene had been an issue since a long time ago. This problem was written in religious manuscripts such as the Jewish Talmud, the Holy Bible, Islamic manuscripts as well as manuscripts from the Greek and Roman period. These manuscripts described the importance of maintaining oral hygiene and also described certain methods to maintain oral hygiene by using natural resources. For example, in 2700 BC Chinese used child urine as a mouth rinse solution to eliminate oral malodor and preventing gum disease. Mouth rinsing became well-known as one of the methods to eliminate oral and dental problems during the Roman Empire and the Greek Empire. Hippocrates recommended mixtures of honey, oil, beer, and other herbs as mouth rinse solutions, while the mixture of salt, vinegar, and alum was famous during the

Roman Empires. In modern days, there are many brands of mouthwash products in the market, which their effectiveness has been approved by the Dental Association, and not just solutions to eliminate oral malodor but also solutions containing therapeutic substances to prevent caries and gum disease (Stuart, 1997; Gurudath, 2012; Zarabadipour, 2020).

Different methods and different devices had been used in many countries and many cultures. Some of the ancient methods of maintaining oral and dental hygiene have been used until recent days. Wu et al (2001) suggested the use of chewing sticks by the Babylonians since 3500 BC as the ancestor of a modern toothbrush as well as the use of chewed toothpicks to maintain oral hygiene which was described in Ancient Greek and Roman literature. For Muslims, maintaining oral hygiene is necessary as it was suggested by Prophet Muhammad Peace Be Upon Him. The use of chewing stick or miswak or siwak is not only related to oral hygiene but also as a religious ritual (Stuart, 1997; Wu et al, 2001). Wu et al (2001) reported that the Orthodox Muslim community is performing oral cleansing using chewing stick five times daily as part of ablution ritual before Shalat or prayer. Muslim parents taught this practice to their children since they were at age of six. Some Muslims are still performing the chewing stick rituals five times daily, some of them are practicing this ritual occasionally and replace the chewing stick with a modern toothbrush, and some of them only use a toothbrush. Moreover, Wu et al suggested that some studies have investigated the efficacy of using a chewing stick compared to a modern toothbrush. Siwak contains substances that have antibacterial and biological effects, it can be used without dentifrice or tooth powder, and the effect is similar to modern toothbrushes if it is used appropriately.

Toothbrush as the common device to maintain oral and dental hygiene in modern days was also found in China in 1498 as historians believed that it is the first toothbrush in the world. During that time, toothbrush was made from ox bone or known as ivory as the

shank and hog bristles. Therefore, the production cost became expensive and only affordable for wealthy people. Hence, the function became an accessory to show the owner's prestige instead of maintaining oral and dental hygiene (Stuart, 1997).

Toothpicks are also known as another tool to clean teeth from food. Similar to toothbrush, the role of toothpicks in ancient time was an accessory for affluent people as it was made from precious metal. People at that time were using the toothpicks to remove the remaining food on their teeth boastfully to show their pride (Stuart, 1997).

Dentifrices also have history alongside human civilization. The purpose of using dentifrices was mostly because of aesthetic reasons. The oldest manuscript was from 4000 BC which described the recipe of Egyptian dentifrice mixtures to clean the teeth. Ancient Chinese used dentifrice to avoid dental caries and to make teeth whiter, and in some civilizations, dentifrice was used to prevent oral malodor. In later days, dentifrices had another role as an aesculapian agent to heal gingival and periodontal diseases. The composition of dentifrices was different from time to time. Ancient people used animal products, flowers, minerals, and other natural resources as the formula to produce dentifrice. However, the idea remained the same as creating a product that has functions as an abrasive, antibacterial, and astringent agent (Stuart, 1997).

Oral and dental health in the modern days

The modern era has changed the pattern of society, economy, demographic size and structure, and the development of science and technology. These changes also affect oral and dental health through physical improvements such as the invention of modern regimes, the invention of sophisticated oral hygiene devices, better health coverage, and better health infrastructure. Non-physical improvements, such as better knowledge and better skill of dental practitioners, as the results of the improvement of curricula in dental school, are also affected by the changes in the modern era.

However, oral and dental diseases are still a silent epidemic (Benjamin, 2010).

Dental caries in modern days is considered a common chronic disease that attacks not only children but also adults. Around twenty-five percent of adults 65 years old and above have suffered from oral diseases, which are the main cause of permanent teeth loss or edentulous (Benjamin, 2010). According to WHO (cited in Petersen, 2003), oral and dental diseases, in general, have significant impacts on the quality of life, as oral and dental care is part of the craniofacial complex which has several functions related to emotion, communication, facial expression, and perception. Therefore, the occurrence of oral and dental diseases may agitate daily activities and daily tasks (Benjamin, 2010; Kanasi et al., 2016). In another perspective, it is expected that the respective population contributes to the economy by implementing a successful aging approach, which can only be attained by eradicating chronic diseases such as oral and dental diseases (Benjamin, 2010; Kanasi et al., 2016; Annele et al., 2019).

In 2050, adults 65 years old and above are estimated to pass 1.5 billion or around twenty-two percent of the total population, of which four-fifths of them will live in less developed countries (Paltasingh & Tyagi, 2012; Lamster, 2016; Kanasi et al., 2016). The prediction of health cost per person in the respective population will not increase significantly (Anderson & Hussey, 2000). However, this matter should be examined thoroughly as oral and dental health economic evaluation is rarely used (Morgan et al., 2012).

The legacy of preventing oral and dental diseases from ancient civilization has been adopted and developed by public health expertise in the modern era. Five stages of preventing diseases have been proposed by Leavel and Clark. These five stages are "health promotion, specific protection, early diagnosis and prompt treatment, disability limitation, and prompt treatment" (cited in Clark 1954, p. 191). The concept of health prevention stages has been used as a reference by many health organizations throughout the world and has

been established as part of the curricula in medical schools, dental schools, and other health-related schools.

In many developed countries, preventing oral and dental diseases has been conducted systematically. These countries have provided accessible and well-coverage health services. The health system is also supported by well-built infrastructure such as tap water fluoridation. Scholars have confirmed the efficacy and safety of consuming fluoridated tap water. As mentioned in a study by Armfield (2005), the prevalence of dental caries in New South Wales decreased as the policy of public water fluoridation has been implemented by the government. Thus, Benjamin (2010) argued that this policy is cost-effective. However, due to its requirement to be supported by well-maintained infrastructure, many developing countries cannot perform this policy as they do not have sufficient infrastructure yet.

The impact of globalization and future challenge

Globalization as the product of the modern era can be advantageous and disadvantageous at the same time. In return, urbanization may also be driven by globalization. Globalization, which is mainly related to political movement and economy, is also related to health through these two factors. As mentioned by Feachem (2001), market liberalization has a positive outcome toward health at the national level through poverty eradication. However, Schrecker and colleagues (2008) argued that although the inexistence of poverty is theoretically advantageous toward health, public health policy is no longer the main priority as the government is more enthusiastic about developing economic policy. Furthermore, there will be health inequity within communities and countries. Health outcomes as an impact of globalization through socioeconomic framework can be criticized from factors such as vulnerabilities and exposures. These two factors are derived from the demand for health resources and health care accessibility (Schrecker et al, 2008). Currency adjustment, privatization, market

liberalization, the cost of health care, and education cost are five pathways of health vulnerability as the impact of globalization (De Vogli & Birbeck, 2005). These pathways were confirmed by Labonte and Schrecker (2007) as they argued that poverty, gender inequality, health policy, health care accessibility, and health cost are the major determinants of vulnerability.

In the period of globalization, two major impacts related to dental health have occurred. Firstly, the prevalence of oral and dental diseases has increased with the emergence of a new type of oral and dental disease. Secondly, globalization also determines the demand and the standard of dental services through socioeconomic development (Hobdell, 2001). Thus, the gap of oral and dental health inequity is also determined by socioeconomic development within countries and communities (Hobdell et al, 2002).

The advancement of technology and science, as the consequences of growing change in population and globalization, has altered and developed the measure of oral and dental diseases. However, oral and dental diseases will remain despite the invention of sophisticated tools and methods.

CONCLUSION

It is believed that with the existence of the human population and civilization, then the oral and dental diseases will remain. Population and society cannot be separated from oral and dental health. The changes in oral and dental health due to the changes in population and society patterns were developed through many aspects. The changes in dietary habits and diet, fertility patterns, industrialization, and globalization have been confirmed. In return, it creates a reciprocal inter-relationship between population and oral health, thus, accommodates better life quality as the final product.

The future of oral and dental health should be regarded seriously as the world is facing an aging population. Oral and dental diseases affect the quality of life particularly in elderly. Preventing oral and dental diseases among elderly becomes necessary, as elderly with

better life quality are expected to have better productivity. Thus, the elderly population is potential to contribute to the economy, together with the working age population.

Regardless of the advancement of science and technology, human behavior remains the significant factor that determines oral and dental health status. Toward the era of the aging population, thus, oral and dental health has an essential contribution in facing the economic challenge in the future.

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