

## Research Article

### Oral Health Workforce Planning in Nigeria

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#### Abstract

Few studies have analysed the current oral health personnel situation in Nigeria. However, as Nigeria is facing a shortage of dentists, there is a need to develop more robust data and undertake research into the most appropriate skill-mix to support and inform future workforce planning. This paper maps the current oral health workforce situation in Nigeria and explores the possibility for skill-mix and the contribution to workforce capacity that could be made by dental care professionals, including dental hygienists, therapists and nurses.

**Keywords:** Dentist; Nigeria; Oral health; Skill-mix; Workforce planning

#### Introduction

##### Workforce planning

Workforce planning is ‘the process of identifying and providing the required health care team needed for optimum health care delivery by specifying the number, grade, type and their composition needed to improve the level of oral health of a nation or community’ [1]. The term ‘skill-mix’ is usually used to describe the mix of posts, grades or occupations in an organization. It may also refer to the experience, knowledge and skills set needed for each job within the organization to achieve its objectives [2].

Few studies have analysed the current oral health personnel situation in Nigeria. Akande [3], enumerated the gap in the number of dentist in Nigeria. He noted that the oral health needs of the population cannot be met by the 1728 dentist available in 1997; hence, more

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dentists need to be trained. Aderinokun [4], recognised that the number of dentists in Nigeria was on a decline, proposed and implemented a primary care model for use in Idikan a rural setting in Nigeria. Ogunbodede [5], reviewed the population of dentists in Nigeria and gender differences from 1981-2000 and how this affected the pattern of services delivered. He proposed more dentists to be trained to meet the growing oral health needs of the Nigerian people.

Previous literatures on workforce planning in Nigeria were inconclusive and neither specified the grade, skill and number of oral health care personnel needed in Nigeria.

However, for countries such as Nigeria where health professionals have a cycle of migration to developed countries, it is important to consider the opportunity cost of training oral health professionals who may seek pastures new in developed countries. Also, it is necessary to address local working conditions and design a workforce trained to meet local needs who are less prone to the attractions of migration due to career opportunities, higher salaries or lifestyle [6].

The aim of this paper is to map the current oral health workforce situation in Nigeria and explore the possibility for skill-mix.

##### Oral health in Nigeria

In Nigeria, most of the oral health surveys have been sporadic and based on convenience samples. This was attributed to lack of funds required to carry out national studies given the size of the country [7]. However, a national study conducted in 2004 showed a high burden of oral diseases with prevalence between 4-58% for various oral health conditions. Oral health trends in Nigeria revealed periodontal disease and dental caries are the two major oral health problems [8]. Malocclusion, dental fluorosis, head and neck tumours and traumatic dental injuries have been reported [9]. Overall disease trends appeared to show dramatic variation, based on the limited data available [10].

The prevalence of periodontal pocket is quite high with deep pockets present in a high proportion of young adolescent. Also angles class II and class III malocclusion and traumatic dental injuries have been reported in children below the age of 15 years [9-11]. However, much of this disease is untreated and population growth means that the size of the challenge is increasing.

Recent oral health survey in Nigeria in 2011 involving 7,630 participants ages 18-80 conducted before the introduction of the oral health policy in 2012 reported over 26.4% having visited the dentist at least once while over 50% has never been to a dentist.

A large proportion (more than 70%) of adult Nigerian have periodontal disease and most carious lesion remain untreated [12]. The survey provided a veritable information for the implementation, monitoring and evaluation of the national oral health policy.

Nigeria operates a three-tier health system (federal, state and local government levels) but all health policies are usually made at the federal level. Whilst most developed countries of the world have up-to-date modelling of oral health workforce, a major barrier to improving

oral health in Nigeria is the absence of an effective model for oral health care delivery [13].

The dramatic increase in the pattern of oral health diseases in Nigeria in the last forty years has necessitated a shift in the way the profession and government respond to the size, shape and skill mix necessary to meet the insatiable demand for dental care. This is supported by the report of shortage of dentists and oral health care workers to meet the dental care needs of the growing dissatisfied public [7,8,12]. There is the need to plan, train, develop and utilize frontline oral health worker of various types due to the role they play within the total health care of the nation [14]. The planning of oral health workforce should be integral part of the general health planning system especially in a developing economy like Nigeria because it has policy decision implications.

To bolster the need for adequate workforce planning in Nigeria, the Oral Health Policy (OHP) was developed and finally adopted in 2012 through multi-stake holder participation of experts in oral health [15]. The OHP is intended to achieve optimal oral health care for Nigerians with a population of one hundred and eighty-two million people (Table 1).

Age-Group (Years)	% by Age-Band	Population in 000s			
		2017	2022	2027	2032
0-14	42%	71,500	74,500	78,000	82,000
15-29	25%	44,500	48,500	51,000	53,000
30-64	25%	54,500	57,500	61,000	65,000
65+	8%	11,500	14,500	17,677	20,000
Total	100%	182,000	195,000	207,677	220,000

**Table 1:** Population forecast by age cohort in Nigeria 2017 to 2032.

**Source:** National Population Commission of Nigeria (2017).

## Methods

### Workforce planning models

A variety of methods and approaches have been used to determine the required workforce needed but there has been no widely adopted framework; However, the most notable framework is the WHO/FDI model, now almost three decades old with its recognised limitations [16,17]. Several authors have proposed more complex models involving system dynamics [18] and scenario planning [19-21], whilst many focus on the simple personnel to population ratio [22], because of its simplicity in providing a comparative overview.

### WHO/FDI model

The World Health Organisation (WHO) and Federation of Dentaire International (FDI) joint working group considered workforce needs in the environment of changing oral disease patterns. This led to a computational model WHO/FDI JWG6 computer model. It estimates oral health personnel requirement by obtaining basic information on the oral health status and the demand for treatment. It enables the users to forecast requirements, by age cohort and by type of care while also including the socio-economic variables to predict the operator to population ratio needed [16]. The model was designed to predict the oral health workforce requirements using a need-based and demand method [23]. However, this model is almost three decades old.

### System dynamics model

This is the model used by the Dutch health care system. This model shows the relationship between ‘owner’ who supplies the finance and the ‘consumer’ that specify the product required and consumes the delivered finance or product. It is designed to assess the impacts of client behaviour on project performance [24,25]. It is a modelling approach that is uncommon, highly complex and sophisticated. The proponents of this model argue that it provides an alternate view in which complex client behaviour are considered and explicitly quantified [25] while Bronkhorst et al., [18] see it as a conceptually sound and more realistic model that offers knowledge to health care managers. Nevertheless, it is not a transparent model that can be used in planning oral health workforce. For this reason, system dynamics method was not explored in this research.

### Dentist-to-population ratio

Dentist-to-population ratio simply counts the number of dentists present within a specific population. This has served as a traditional measure of need for oral health professional, however, it does not provide information on the geographical spread and may not be able to explain the poor oral health seen in some people despite ‘optimal’ dentist-to-population ratio [26].

### Scenario planning

Scenario planning is a method that organisations use to make flexible long-term plans. It is a process of testing different strategies and preparing responses to probable future events. It involves: (i) Making assumptions; (ii) Bringing together into a viable framework; (iii) Producing initial mini-scenario; (iv) Reducing to two or three scenarios; (v) Assessing and testing scenarios; (vi) Forecasting into future and (vii) Determination of critical outcomes [20].

Due to the limitations of the other workforce planning tool and its overdependence on the use of dentists for providing oral health care, operational research using scenario planning will be used to explore the number of hygienists, therapists and nurses, needed for Nigeria now and in the future (2022, 2027, 2032 and 2037).

Recent work in Wales by Evans et al. [27], suggests that therapists or hygienists can perform 43% of time taken to provide care by dentist while the dentist can provide the rest of the clinical time (57%). Using operational research planning and combining the findings of Evans et al. [27], with additional scenario planning can be used to explore the development of a locally more appropriate workforce.

## Results

### Data collection

This involved estimating the demand for oral health care in Nigeria using the data collected on the prevalence of oral diseases of the Nigerian population and demographic data from national population commission. Allowances will be made for modifying factors like effect of national or regional oral health policy, socio-economic situation and practice profile of the country, resources allocated to oral health and the type and capacity of existing health care personnel to determine the appropriate care needs. The data collected was fed into excel spread sheet to determine the projected number of dentist needed in the future (2017, 2022, 2027 and 2032). Furthermore, the oral health skill mix was explored using hygienists, therapists and nurses.

### Demand model

The demand for oral health care was based on prevalence of oral diseases, patterns of dental attendance and the reported treatment rates from private, government and tertiary institutions in Nigeria (Table 2).

Epidemiology	Population	Prevalence	Age
Caries	5714	4-30% (DFMT=0.6)	6-20
Periodontitis	2230	15-58%	15-40
Traumatic dental lesions	1401	11-30%	10-15
Orthodontic treatment	1394	8-15%	10-19
Oral health survey	7630	26.4% (Demand for care)	18-80
National survey	4692	N/A	12-15

**Table 2:** Oral health demand and needs of the population of Nigerians.

Courtesy oral health policy 2012 federal ministry of health  
N/A=Not Available  
DFMT=Decayed Missing and Filled Teeth

The demand model was estimated based on the last oral health survey in Nigeria in 2011 involving 7,630 participants ages 18-80 conducted before the introduction of the oral health policy in 2012 which reported over 26.4% having visited the dentist at least once while over 50% has never been to a dentist (Table 2). Estimated demand for oral health care was about 25% to 50% of the population of Nigerians (Figure 1).



**Figure 1:** Projected demand model.

- Demand for oral care as a percentage of population
- Demand for oral care is estimated based on reported uptake of treatment
- Demand for oral health care will increase with population increase

### Supply model

The oral health workforce in Nigeria includes dentists, hygienists, therapists, dental nurses and dental technologists [28]. However, the dental technologists have little contact with patient. Information on the migration pattern of dentists in Nigeria is sparse, but current evidence suggests about 20% of the current number of dentists in Nigeria are practising abroad [29,30]. However, oral health workforce migration, death and retirement were based on 20% as the net loss of dental practitioners from the medical and dental council register.

In Nigeria there are about 4060 dentists, 1220 therapists, 1540 dental nurses, 500 dental hygienists (Table 3). There are nine accre-

ditioned dental schools located in Nigeria, two schools of dental therapy and hygienist and eight dental nursing schools [29]. Dentist number in Nigeria has continued to decrease due to many leavers from 1990 till date [29]. This is due to poor conditions of services and exodus to developed countries for pastures new. There is need in the future for the number of dental care professional to increase.

Professionals	2017	2022	2027	2032
Dentists	4,060	5,290	6,090	6960
<b>Dentists (Minus 20% due to migration and death)*</b>				
Dental therapists	1,220	1,370	1,520	1,670
Dental nurses	1,540	1800	2,140	2,440
Hygienists	500	600	780	880
Total dental professionals involved in clinical care	7,320	9060	10,530	11950

**Table 3:** Projected oral health workforce from 2017 to 2032.

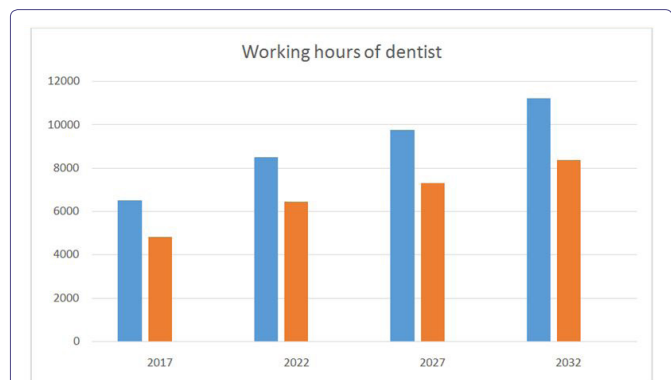
**Source:** Medical and Dental Council of Nigeria (2017) [29].

\*Average loss of dentists due to migration, death and retirement.

- Calculation of dentists, dental therapists, hygienists, nurses are based on the present oral health workforce and those in training

A total of 446 dental clinics and hospitals presently provide oral health care services across the country [31]. The management of these facilities is influenced by their funding lines, which may derive from government (federal or state), private, corporate or faith-based bodies. Most of dental facilities are in cities and towns. Only 20% of dentists in both the private and public sectors work in rural areas, where more than half of the population reside [5].

Workforce supply will involve the number of working hours of dentists and those in training (Figure 2). The annual number of dentists entering the market will be equal to the number of new graduates minus the number of dentists leaving the profession because of retirement, death and immigration. Also, the current and future number of hygienists, therapists and nurses working hours were explored for optimal skill mix (Figure 3).

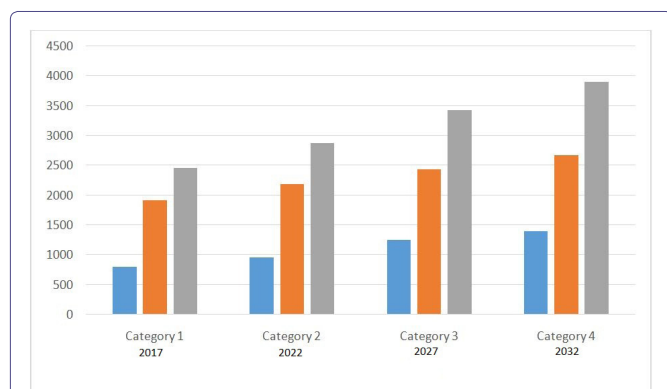


**Figure 2:** Projected supply graph.

**Hours in 000s**

Blue=Dentist work full time 1600 hours per annum

Red=Dentist work part time 1200 hours per annum



**Figure 3:** Working hours of hygienists, therapists and dental nurses.

**Hours in 000s**

Blue=Hygienist work full time 1600 hours per annum  
 Red=Therapist work full time 1600 hours per annum  
 Grey=Dental nurses work full time 1600 hours per annum

**Education and training**

The training of dentist is carried out in nine dental schools leading to the award of a Bachelor of Dental surgery BDS or B CH D and the National University Commission is charged with the responsibility of accrediting undergraduate programmes.

The training lasts for 5-6 years depending on the year of entry. Six years for those entering straight from secondary schools through a university matriculation examination and 5 years for those with a levels or first degree. A total of 200 dentists are produced annually [29].

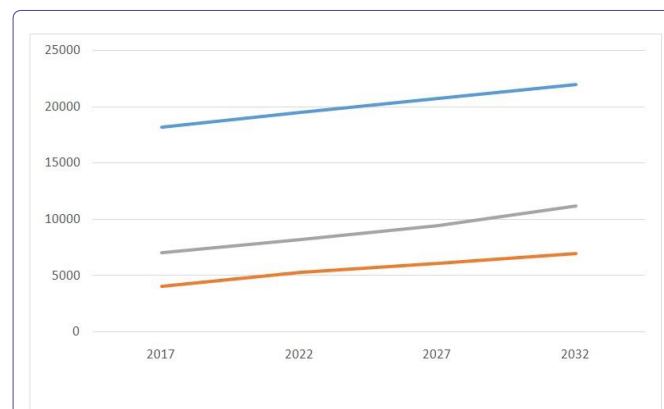
The National Dental Therapist’s Board is responsible for accreditation of dental therapists and hygienists [32]. These groups are involved in advocacy for oral health in the country and have been actively involved in clinical duties which include scaling and polishing, curettage and root planning and dressing of periodontal pocket. They do not perform extraction. About 40 dental hygienists and 30 therapists are trained each year.

The National Board for Technical Education regulates the award of diplomas from the eight dental nursing schools in Nigeria. The dental nurses’ role involves assisting the dental surgeon in all procedures and work that is carried out. This includes oral hygiene instructions and motivation and all other work as prescribed under the supervision of the dentist. About 100 nurses are trained each year [33].

**Demand supply gap**

Based on the available number of dentists (4,060) to the general population in providing oral health care, there exist gaps in the level of care provided. The number of dentists is about 10% of what is needed by the Nigerian population which could potentially increase to 20% if dental hygienists, therapists and nurses are given expanded roles (Figure 4). The dentist to population ratio in Nigeria in 2017 is 1:44,830. Using the broad-brush dentist-to-population ratio of 1:5,000 recommended by the WHO for developing countries, would suggest that about 36,400 full time dentists are required for a population of one hundred and eighty-two million Nigerians. However as estimated

demand for oral health care was about 25% to 50% of the population, the estimated number of dentist needed will be less (Figure 4).



**Figure 4:** Demand supply gap.

Blue=Number of dentist required based on demand for oral health care  
 Red=Dentist supply  
 Grey=Using Hygienist, Therapist and Nurse to do 43% role of dentist  
 Dentists, Hygienists, Therapist and Nurses working full time.

**Workforce skill-mix**

Oral health workforce shortages and skill-mix imbalance are significant workforce challenges. There are many combination of health worker skill mixes that could be used in health care services [34]. Various approaches have been adopted in developed countries [27,35] however none has been proposed in Africa.

**Scenario 1**

**No change approach:** Involve training more dentists to meet the oral health care demand. The implication of training more dentists will be to train other professionals that will work with the dentists, infrastructure the dentists will need, salary and cost of training. This may result in higher probability of emigration (brain drain) and the trained dentists may be unwilling to work in rural areas [36]. Also, this approach will be impracticable in Nigeria were less than 1% is allocated for oral health care [37].

**Scenario 2**

**Train hygienists, therapists and nurses to perform 43% of dentist job:** Train and utilise more hygienists, therapists and nurses for expanded roles when there is shortage of dentists to work in the rural areas (Figure 4). This will result in lower initial and other costs [14]. The hygienists, therapists and nurses will be able to provide 43% of clinical hours taken by dentist to provide care when diagnostic and treatment planning are delegated to them [27]. This may be achievable due to the reduced cost of training hygienists, therapists and nurses compared to dentists and there will higher probability of retention in the rural areas after training.

**Discussion**

Using workforce skill-mix the number of dentists needing to be trained will be less if more hygienists, therapists and nurses can be trained. In Nigeria, hygienists, therapists and nurse can only perform clinical duties delegated to them by the dentists. And they could be



utilised in delegated clinical care (43% of dentist work). Nigeria just like some other developing countries is facing an under-supply of adequately trained oral health personnel. Based on the predicted number of dentists needed in Nigeria for 2017, using the scenario planning combined with reported demand for oral health care, an additional 14,140 full time dentists will be required with the present 4,060 dental practitioners to meet the oral health demand (Figure 3). This imbalance in dental manpower poses a challenge to oral health care managers and planners.

The changing disease trends in the last four decades has corroborated the need to utilize the hygienists, therapists and dental nurses for expanded roles in meeting the oral health demands of Nigerians. Using scenario planning to explore skill mix: hygienists, therapists and nurses could potentially reduce the number of dentist required if 43% of dentist job are delegated to them (Figure 3). However, they would need to work full time (1600 hours) to potentially contribute 20% of the activity required to meet the current reported oral health demand of the population.

However, in 2022 with increasing population about 19,500 full time dentists will be required. Hygienist, therapist and dental nurses could potentially increase the oral health workforce if given expanded role. They can be utilized in the rural areas to meet the oral health demands of the population.

As oral health services demand is expected to grow commensurately with population growth as seen in developed countries like Australia [35]. There is therefore the need to expand the oral health workforce to meet the required number. The implication is that more funds needs to be allocated for manpower training, development and research. Also, consideration needs to be given to the training of hygienists, therapists and nurses as their training require a shorter period. The time taken to train dentists is 5 or 6 years while hygienists and therapists can be trained in 3 years.

### Strengths and limitations of this research

Workforce planning is an art as well as a science. The strength of this research is its ability to use a workforce planning methodology developed specifically for oral health to explore the capability of the current workforce to address oral health demands of the population of Nigeria.

The limitations identified in this study have been identified in the literature; first, it focuses only on the use of dentists for providing oral health care [23]; second, there is no recognition of the geographic spread of dental manpower between urban and rural areas [3,4,38]; third, it depends on robust data for accurate workforce modelling which are not readily available [3-5]; fourth, the sparse or non-existent literature on workforce planning on which to build [3,4,13].

Using scenario planning and drawing on other research findings, this enabled consideration of the role that hygienists, therapists and nurses may play in dental care. Mindful of the fact that clinical dental care in Nigeria will be very different to the UK where the original research was undertaken and that dentists and hygienists/therapists do not work at the same rate, the use of these skill-mix scenarios can contribute by identifying the optimum numbers of the mix of health workers needed for oral health care. However, this reveals the fifth limitation of the study, the absence of information on appropriate

'task-shifting', which has significant potential for Nigeria and innumerable political, financial and social implications, the complexity of which has been outlined by Lehmann [34,39].

### Contribution to knowledge

The need to train additional numbers of dentists to supplement the current workforce is totally unrealistic for an emerging and low/medium income country. Thus, this research proposed the use of hygienists, therapists and nurses to perform part of the work of dentists in the rural areas. Exploring the skill-mix will enable hygienist, therapists and nurses to provide evidence-based oral health promotion, infection control, record keeping and the provision of pain relief and referral of appropriate cases and help to prevent diseases in disadvantaged sub-groups. They will also provide basic oral health services according to the need of the local population.

This study suggests that training hygienists, therapists and nurses can make a significant contribution to the workforce and the population needs. Whether the remit should be the same as that in the UK, whereby dental care professionals such as hygienists/therapists have care delegated to them by dentists, is a matter of debate and ongoing review.

The implications for Nigeria are fourfold; first, the need to train more dentists; second, the potential for further training and use of existing hygienists, therapists and nurses with expanded roles in oral healthcare delivery. Third, it highlights the need to retain the dental workforce when trained, rather than lose them to other countries; dental auxiliaries are perhaps less likely to move; furthermore, if an effective model of team working could be developed and appropriately resourced, perhaps dentists who have traditionally sought employment elsewhere may find it attractive to stay or return to Nigeria.

### Conclusion

In summary, this research has mapped the current size of the oral health workforce in Nigeria and has explored the possibility for skill-mix. Workforce data highlights the vast shortage of dentists to meet the oral health needs of Nigerians now and the future. The baseline dentist work force is estimated to provide at best only 10% of the activity required to meet the current oral health needs of the population; hence, drastic action is required. This study suggests that alternative skill-mix with expanded roles could promote oral health and treat oral diseases and recommend periodic national epidemiological surveys for appropriate determination of oral health needs and demand in Nigeria.

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