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RESEARCH ARTICLE

Financial, Supplies, and Human Resource Preparedness in Management of Covid-19 Pandemic Among Dental Facilities in Nairobi County Kenya

[version 1; peer review: 1 approved]

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Abstract

Background

The coronavirus disease (COVID-19) pandemic has put a strain on healthcare facilities worldwide. Dental facilities pose the highest risk of COVID-19 transmission because of the aerosol-generating procedures involved in dental practice. This study aimed to determine financial, supply, and human resource preparedness in the management of the COVID-19 pandemic among dental facilities in Nairobi County, Kenya.

Methods

An analytical cross-sectional study was conducted using a mixed-methods approach among 183 dental facilities in Nairobi County. Data were collected using the KoboCollect questionnaire and analyzed using MS Excel and SPSS version 26. The readiness of dental facilities was assessed using the ReadyScore Criteria. Qualitative data were collected through one-on-one interviews with key informants and analyzed thematically.

Results

Readyscore Criteria analysis showed that 39 (21.3%) of the evaluated dental facilities were considered "ready," while 133 (72.7%) and 11 (6%) were considered to have "work to do" and "not ready" for the

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pandemic. Bivariate analysis showed that the level of facilities ($p<0.001$), presence of other departments ($p<0.001$), funds sufficiency for COVID-19 emergency response ($p=0.001$), and clients attended per month ($p=0.017$) were statistically significant factors associated with pandemic preparedness scores. Regression analysis revealed that the presence of other departments among dental facilities was a significant predictor of readiness, with a 4.5 times higher likelihood of being ready for a pandemic (aOR 4.591; 1.471–14.327, $p=0.009$) compared to other facilities.

Conclusions

Support from healthcare authorities and capacity-building initiatives are recommended to enhance preparedness and resilience among dental facilities in the face of the COVID-19 pandemic.

Plain language summary

The COVID-19 pandemic brought a strain on healthcare facilities across the globe since the start of the pandemic in December 2019. The transmission of the virus primarily occurred through inhalation, direct mucous contact, ingestion, and contact with saliva droplets all with significant bearing on dental practice. Dental professionals are at the greatest risk of contracting the disease due to working in the mouth. This study was carried out among 183 dental facilities heads in Nairobi County as well as 4 key informants. The study results were: that 39(21.3%) of the evaluated dental facilities were considered "ready," while 133 (72.7%) and 11 (6%) were considered to have "work to do" and "not ready" for the pandemic. This study revealed that dental facilities evaluated had financial constraints in pandemic preparedness for COVID-19. Most of the dental facilities evaluated sourced finances for dealing with the pandemic from patient service charges. Over half of the facilities indicated funds were not sufficient to address COVID-19. The study therefore recommended Support from healthcare authorities and capacity-building initiatives to enhance preparedness and resilience among dental facilities in the face of the COVID-19 pandemic.

Keywords

COVID-19, Dental Facility Preparedness, Emergency, Response, Kenya

This article is included in the Health Sciences gateway.

This article is included in the European & Developing Countries Clinical Trials Partnership (EDCTP) gateway.

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Introduction

The COVID-19 pandemic has exposed preparedness challenges to healthcare systems worldwide, particularly in dental clinics. Dental professionals are the most susceptible healthcare workers because of the nature of their work. The proximity of the dental team to patients could readily lead to the spread of the disease from infected patients to the dental team, or from the infected dental team to the patient in cases where appropriate protective procedures are not undertaken (Banakar *et al.*, 2020). This led to the recommendation by government bodies and oral healthcare institutions to close the dental care system as one of the response measures to minimize in-person transmission (Barnett *et al.*, 2020). In a study by Iurcov *et al.* (2021), 65.51% of dentists registered a decrease in the number of patients at the beginning of the pandemic, leading to over 70% loss in financial income, with over 70% unable to sustain their employees for up to 3 months. The financial implications of the pandemic for dental facilities were multivariable in nature. Revenue loss occurs due to the temporary closure of dental facilities and the perspective that dental care is not an emergency or a necessary service (WHO, 2023). Only emergency treatment is available in hospitals prioritizing emergency conditions over preventive dental health procedures, leading to a financial crisis for dental health departments (Chamorro-Petronacci *et al.*, 2020).

Additionally, due to disruption of the supply chain, the cost of procuring personal protective equipment (PPE) and environmental disinfection supplies has increased, adding another layer of financial stress for dental facilities (Guner *et al.*, 2022). A crucial part of the recommendations was the use of personal protective equipment (PPE) which serves as a nontherapeutic measure to help curb the spread of the disease. However, the success of these recommendations depends on the supply and availability of PPEs and sterilization of equipment and disinfectants. According to Iurcov *et al.* (2021), 65.1% of doctors in the northern parts of Italy encountered difficulties in purchasing protective suits and medical supplies, with a majority focusing on the quality and cost of purchasing protective suits.

The lack of PPE, fear and stigmatization of health workers, and lack of training of dental healthcare personnel have affected human resource preparedness. According to a study conducted in Poland, unpreparedness, anxiety, and phobia associated with COVID-19 in public and private settings and dental facilities compelled 71.2% of dentists to willingly suspend their practice (Tysiąc-Miśta & Dziedzic, 2020). This study concurs with the need to rethink healthcare systems, particularly in developing countries, to address future emergencies and mitigate the negative effects that may arise during emergencies.

Methods

Study site

The study area was Nairobi County with an estimated population of 4.3m people (2019 Census). It also comprises 221 public facilities and two to six private dental facilities. The dental services offered in these facilities include but are not limited to oral diagnosis, extraction, fillings, root canal treatment, disimpassion, crowns and bridges, prosthodontics, full-mouth scaling and prophylaxis, dry socket management, and referral services. Nairobi County was selected because of the high prevalence of COVID 19 cases in Kenya. It also has the highest percentage of facilities offering dental services in Kenya (Ogira *et al.*, 2022).

Study design

This study adopted a cross-sectional design. The mixed-method approach was used to gather both quantitative and qualitative data for the broad purposes of breadth and depth of understanding and collaboration (Salahshoori *et al.*, 2021).

Study population

The study population included 221 dental facilities across Nairobi County categorized as either public (13) or private and mission-based (208).

Inclusion criteria. A total of 221 facilities were included in this study. The study engaged the heads of the dental facilities or their equivalents in the facility (questionnaire) and selected four key informants, those informed on county dental health delivery (interview).

Exclusion criteria. The study excluded the heads of facilities who were not willing to take part and officials who were not in session.

Sampling and sample size

Census sampling was used in this study. Therefore, the heads of each of the 221 dental facilities in Nairobi were included in this study.

Study variables

The dependent variable was the COVID-19 emergency preparedness. The independent variables are the main factors associated with dental facility preparedness, such as finance, supplies, and human resources, including (emergency response kitts, budgetary allocation emergencies, main source of funding, Adequacy of the IPC supplies, and flexibility of resources).

Data collection tools

A semi-structured questionnaire was the main tool used to collect the data. Considering the educational level of the respondents, the questionnaires were self-administered. The study also used a key informant interview (KII) guide to the four key informants. Purposive sampling was used to identify key informants.

Data collection procedure

Quantitative data were collected using the KoboCollect Application. It was estimated 15-minute period to complete the questionnaire. Upon completion of the survey tool, participants submitted their responses using the KoboCollect Application. Qualitative data were collected through interviews done using in-person interviews with an estimated maximum duration of 15 minutes. Once the interview was completed, the recorded data were saved in a password-protected gadget before being shared with the data analyst for verbatim transcription and analysis.

Data analysis and management

The data were coded and organized in Excel 365 and exported to SPSS for analysis. This was followed by a descriptive analysis of the facility to determine financial, supply, and human resource factors in preparedness for the management of the COVID 19 pandemic. Chi-square tests for proportions were used for bivariate analysis. Multivariate logistic regression was used to determine factors associated with dental facility preparedness for covid-19. The results of these analyses are presented in standard tables and frequencies.

Results

Financial related factors to pandemic preparedness

The results indicated that most facilities received funds to run their operations from patient service charges (n = 178, 97.3%). Almost all the facilities that reported receiving support from donations and grants were mission- or faith-based facilities, apart from two government facilities. Conversely, most of the facilities that reported using loans for operational financial requirements were private. Of the facilities, 55.7% (n = 102) reported that funds available to them were not sufficient for COVID-19 emergency response, while 58.5% (n = 107) had no emergency response kitty, translating to an equal number of facilities (n = 107, 58.5%) that could not purchase emergency response appliances on need. Despite these challenges, over half of the facilities (n = 104, 56.8%) reported having an emergency response plan (Table 1).

Pandemic preparedness scores

Almost two-thirds of the facilities had "work to do" status (n = 133, 72.7%) to health emergencies based on the evaluation of financial, supply, and human resource factors. Only

Table 1. Use of finances in dental facilities.

		Frequency	Percent
Sufficiency of funds to address COVID-19	No	102	55.7
	Yes	81	44.3
	Total	183	100.0
		Frequency	Percent
Allocation of an emergency response kitty	No	107	58.5
	Yes	76	41.5
	Total	183	100.0
		Frequency	Percent
Well stipulated budgetary protocol	No	105	57.4
	Yes	78	42.6
	Total	183	100.0
		Frequency	Percent
Ability buy emergency response appliance on need	No	106	57.9
	Yes	77	42.1
	Total	183	100.0
		Frequency	Percent
Shared budget with other departments	No	81	44.3
	Yes	102	55.7
	Total	183	100.0
		Frequency	Percent
Whether shared budget affect COVID-19 preparedness	No	113	61.7
	Yes	70	38.3
	Total	183	100.0
		Frequency	Percent
Emergency response plan	No	79	43.2
	Yes	104	56.8
	Total	183	100.0

about one-fifth of the facilities in this study were determined to be fully prepared for health emergencies in the background of COVID-19 (n = 39, 21.3%), with a mean score of 64.5% and a median of 63.3% (Table 2).

The preparedness scores proved a determinant in the continued operation of dental services among the facilities evaluated, although not to a similar magnitude. When asked if the incase of another lethal variant of COVID-19 would occur in Kenya, the facility wound close dental services only slightly above average cited that they would continue with dental services (n = 102, 55.7%).

Factors associated with pandemic preparedness scores

Bivariate analysis of the variables showed that the level of facility (p <0.001), presence of other departments (p <0.001), funds sufficiency for COVID-19 emergency response (p = 0.001), and clients attended per month (p = 0.017) were statistically significant with scores for pandemic preparedness (Table 3).

Analysis

The findings revealed that public facilities had a 75.5% reduced risk of poor pandemic preparedness (OR 0.245; 0.067 – 0.983, p = 0.038). Dental facilities that had been operational for up to 10 years as compared to those operational more than 10 years were 1.9 times likely to be ready for a pandemic (OR 1.945; 0.331 – 3.279, p = 0.004). In addition, primary (OR 3.837; 1.825–8.067, p value ≤ 0.001) and secondary level (OR 0.307; 0.145–0.648, p value = 0.003) dental facilities showed favorable odds for readiness. Finally, dental facilities that existed in the presence of other departments were more prepared than stand-alone facilities (OR 4.536; 2.573–22.533, p <0.001) (Table 4).

After controlling all confounding factors, only the presence of other departments among the dental facilities proved significant in predicting readiness. Dental facilities with other departments were 4.5 times likely to be ready for a pandemic (aOR 4.591; 1.471 - 14.327, p value 0.009) (Table 5).

Table 2. Pandemic preparedness percentage scores.

		Frequency	Percent
ReadyScore classification	Not ready	11	6.0
	Work to do	133	72.7
	Ready	39	21.3
	Total	183	100.0
Preparedness percentage scores			
Mean			64.516
Median			63.300
Variance			299.311
Range			73.5

Discussion

This study aimed to determine the level of resource preparedness that contributes to the management of suspected COVID-19 cases in dental clinics in Nairobi County. Regarding financial preparedness, this study evaluated three variables: sufficiency of funds, budgetary guidelines, and challenges in the use of finances in dental facilities. Notably, 55.7% (n = 102) of the facilities reported that funds available to them were not sufficient for COVID-19 emergency response, while 58.5% (n = 107) had no emergency response, translating to an equal number of facilities (n = 107, 58.5%) that could not purchase emergency response appliances on need. Research has shown that emergency funds, flexible resource allocation, and fund diversification away from patient fees are crucial for cost-effective pandemic response (Fiest *et al.*, 2020; Kain & Fowler, 2019).

Hospital budgetary funds for emergency services are essential because these resources are needed to ensure that institutions have adequate supplies, necessary infrastructural improvements, and well-trained personnel (Biancolella *et al.*, 2022; Margini *et al.*, 2020; Sanders *et al.*, 2021). The study showed that 28.4% of all dentists had budgetary allocations, while 72% of these dental clinics were receiving their finances through the remuneration received from patient charges, which was nearly four times higher than those that were government-funded at 14.2%. This dependency on patient fees created financial challenges because there was a drop in patient appointments during the pandemic when patients were not able to have appointments and procedures due to government policies. The study concluded that dental facilities need to employ multiple funding sources as well as stable financing models, which will make dental facilities less dependent on patients' fees as the main income source.

The protection of healthcare providers was pivotal in the COVID-19 emergency response owing to their close contact with patients with COVID-19 (Mahendradhata *et al.*, 2021). However, irrespective of the evidenced benefits, there were shortages of PPE, misuse, and general confusion regarding the type and method of using different available supplies (Battista *et al.*, 2021). Additionally, Sanders *et al.* (2021) found disparities between private and public hospitals, indicating inequality in the availability of supplies in dental health facilities. The study further shows that supply preparedness in public dental facilities was affected by a lack of collaboration and communication with government agencies, including KEMSA, causing delays in supplies. On the other hand, supply related challenges in private facilities are caused by financial challenges that affect the cost of supplies, thus determining the availability of requisite supplies.

Human resources are an integral part of healthcare delivery and must be considered in any effective system. The study showed that 139 (76%) staff from a third of the facilities in this study had undergone training on IPC protocols related to COVID-19 emergency preparedness. The capacity of

Table 3. **Bivariate analysis of factors associated with pandemic preparedness.**

		Preparedness score
Preparedness score	Pearson Correlation	1
	Sig. (2-tailed)	
	N	183
Level of facility	Pearson Correlation	.361**
	Sig. (2-tailed)	.000
	N	183
Type of facility	Pearson Correlation	-.003
	Sig. (2-tailed)	.962
	N	183
Staff numbers	Pearson Correlation	-.054
	Sig. (2-tailed)	.467
	N	183
Duration of operation	Pearson Correlation	.144
	Sig. (2-tailed)	.051
	N	183
Presence of other departments	Pearson Correlation	-.409**
	Sig. (2-tailed)	.000
	N	183
Fund sufficiency for COVID emergency response	Pearson Correlation	-.253**
	Sig. (2-tailed)	.001
	N	183
Clients per month	Pearson Correlation	.177*
	Sig. (2-tailed)	.017
	N	183

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4. **Bivariate analysis.**

Variables	Category	OR	95% CI	p-value
Type of facility	Public dental facilities vs Others	0.245	0.067 - 0.893	0.038
	Private dental facilities vs Others	1.974	0.812 - 4.795	0.138
	Mission/ Faith based facilities vs Others	0.942	0.331 - 2.718	1.000
Period of operation	Upto 10 years	1.945	1.154 - 3.279	0.004
	Above 10 years	0.629	0.482 - 0.821	
Clients per month	0 - 500 Clients	1.060	0.947 - 1.186	0.251
	500 - 1000 clients	0.474	0.146 - 1.537	

Variables	Category	OR	95% CI	p-value
Number of staff	0 - 10 staff members	0.878	0.792 - 0.974	
	11 - 20 staff members	3.250	0.803 - 13.159	0.074
Facility level	Primary level vs Others	3.837	1.825 - 8.067	<0.001
	Secondary level vs Others	0.307	0.145 - 0.648	0.003
	Tertiary levels vs Others	0.129	0.011 - 1.466	0.115
Presence of other departments	Yes	4.536	2.573 - 22.533	<0.001
	No	0.596	0.495 - 0.717	

Table 5. Regression analysis.

Variables	Category	OR	95% CI	p-value	aOR	95% CI	p value
Type of facility	Public dental facilities vs Others	0.245	0.067 - 0.893	0.038	0.363	0.092 - 1.436	0.149
Period of operation	Upto 10 years	1.945	1.154 - 3.279	0.004	1.806	0.778 - 4.194	0.169
Number of staff	11 - 20 staff members	3.250	0.803 - 13.159	0.074			
Facility level	Primary level vs Others	3.837	1.825 - 8.067	<0.001	7.407	0.613 - 89.459	0.115
	Secondary level vs Others	0.307	0.145 - 0.648	0.003	3.016	0.246 - 36.982	0.388
Presence of other departments	Yes	4.536	2.573 - 22.533	<0.001	4.591	1.471 - 14.327	0.009

healthcare staff to handle the pandemic was crucial, and training was an important aspect of disease management by ensuring adherence to screening, diagnosis, management, and prevention guidelines provided by the WHO. Since COVID-19 is highly transmissible, adherence to infection prevention control measures is very important in reducing the disease burden (Aimrane *et al*., 2022; Hu *et al*., 2021).

Conclusion

This study aimed to explore financial, supply related, and human resource preparedness variables that had an impact on the dental facility response to the COVID-19 pandemic in Nairobi County, Kenya. The study revealed that financial, supply, and human resources aspects of the health care system had a strong relationship with preparedness levels and the ability to effectively manage a pandemic. Lack of work plans, budgeting policies, and allocation of funds to the dental department affected financial preparedness and the ability to effectively fund pandemic programs. Disruption of the supply chain impacts supply preparedness, affecting the purchase and quality of supplies in dental health facilities. Finally, gaps in the training of dental workers and IPC focal persons hindered the ability to control the spread of infections. The study concluded that dental health system readiness was significantly associated with financial, supply, and human resource preparedness. This study further highlights the knowledge gaps in human resources and poor budgetary allocation. This can be bridged by conducting training programs to build personnel capacities.

Limitations of the study

This study did not include the opinions of the heads of facilities who were unwilling to participate. Therefore, there could be a potential bias that limits the generalizability of the findings.

Ethical consideration

Approval was obtained from relevant approvals, including the Jomo Kenyatta University of Agriculture and Technology (JKUAT)Institutional Scientific and Ethics Review Committee (ISREC) JKU/ISREC/02316/0847 on the 20th of April 2023, National Commission for Science Technology, and Innovation (NACOSTI) NACOSTI/P/23/25744 on 11th May 2023, and the Nairobi County Director of Health. Each participant was asked to give his/her written consent before participating in the study and the participant's identity was not revealed in the study consent. The informants were at liberty to refuse to participate in the study without any repercussions. Anonymity, confidentiality was also assured. Data security measures, including password-protected computers and locked cabinets, were implemented to safeguard collected information and maintain data privacy and confidentiality.

Data availability

Underlying data

Dryad: Data from: Financial, supplies, and human resource preparedness in management of COVID-19 pandemic among dental facilities in Nairobi County, Kenya. https://doi.org/10.5061/dryad.brv15dvhj (Chematia *et al.*, 2024a).

This project contains the following underlying data:

- HAZEL DATA SPSS 12 June 2024
- README.md (summary of what the raw data contains)

Data are available under the terms of the Creative Commons Zero "No rights reserved" data waiver (CC0 1.0 Public domain dedication).

Extended data

Zenodo: Data from: Financial, supplies, and human resource preparedness in management of COVID-19 pandemic among dental facilities in Nairobi County, Kenya, https://doi.org/10.5281/zenodo.12720712 (Chematia *et al.*, 2024b).

This project contains the following extended data:

Appendix_II_QUESTIONNAIRE.docx

Appendix_III_KII_GUIDES.docx

Appendix_I_CONSENTS.docx

This work is distributed under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0) Both kobo collect is open-source android app that was used for collecting survey data

Author's contribution

The author participated in the study's design and the paper's writing.

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This study aimed to determine financial, supply, and human resource preparedness in the management of the COVID-19 pandemic among dental facilities in Nairobi County, Kenya.
The authors constructed the study to address emerging situation among dental facilities during COVID-19 pandemic. The methodology was selected appropriate to study design. The results were presented and analysed in systematic and approachable manner.
The discussion highlighted that lack of work plans, budgeting policies, and allocation of funds to the dental department affected financial preparedness and the ability to effectively fund pandemic programs. The limitations that authors highlighted could be further elaborated to explain the reason why heads of facilities were unwilling to participate in the study. In conclusion the study highlighted importance of fundamental needs for staff training and financial support in preparation to potential future epidemic/pandemic.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and does the work have academic merit?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: previous work on COVId-19 in dental facilities and national and internation guidleines

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.