Factors that Influenced Clinic Utilization by Diabetes Mellitus Type II patients during COVID-19 Pandemic at The Kakamega County General Hospital

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Abstract

Diabetes Mellitus (DM) has an estimated global disease burden of 85- 89%, a prevalence rate of 5.3% in Kenya, and an increased mortality hazard. While sounding an alert at the onset of Corona Virus Disease 2019 (COVID-19), the World Health Organization (WHO) noted the greater risk of COVID-19 deaths in older individuals and those with chronic diseases like DM. This study examined the influence of exposure variables such as patient characteristics, disease complexity, facility-related factors, and COVID-19 restrictions on utilization of diabetes mellitus type II (DM II) clinics during the Covid-19 pandemic at Kakamega County General Hospital (KCGH). The study employed cross sectional survey research design. A sample size of 211 randomly sampled DM II patients and 6 health care workers purposively sampled for Focused Group Discussion (FGD) was obtained from a target population of 467 DM II patients attending diabetes clinic at KCGH, and 12 healthcare workers. Data was collected using structured questionnaire for the DM II patients, and an interview guide for FGD. Qualitative data was analyzed thematically, while descriptive and inferential statistics were used to analyze quantitative data. Findings revealed a significant association of $p<0.05$ between 6 out of 10 exposure variables investigated and the outcome variable. Logistic regression analysis was used to determine the highest odds ratio of 2.0 for medication availability and lowest odds ratio of 0.3 for lack of family support. The study recommends that KCGH, superintendent, in consultation with healthcare workers in charge of the diabetes clinic and the county department of health develops a strategy to implement telemedicine adaptation policies and surveillance to reduce in person clinic visits. In addition, KCGH superintendent should collaborate with the national health ministry to establish a resilient medical supply policy for pandemics.

Keywords: *COVID-19 pandemic, specialty clinic utilization, Diabetes Mellitus type II*

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1.0 Introduction

Delivery of healthcare services entails mobilization and allocation of resources for disease prevention and treatment. This is achieved through optimization of health system infrastructure via leadership and governance, health financing, health service delivery, human resources for health, procurement of medical products and technologies, and health information systems, which ensure provision of effective, safe, personal and non-personal health interventions to those that need them (World Health Organization [WHO], 2007). Health care is largely underutilized in the developing world (O'Donnell, 2007). According to Kenya National Bureau of Statistics (KNBS) (2023), Kenya continues to witness underutilization of health services resulting in mortality rate of 41 deaths for under 5 years, 32 infant deaths and 21 neonatal deaths for every 1000 live births, and incidence of non-communicable diseases.

The study anchored on service delivery pillar, explored utilization of health services and examined effect of system responsiveness to service provision during the COVID-19 pandemic. Covid-19 was declared universal health emergency on 30th January 2020, and a pandemic on 11th March 2020 following its unprecedented increase. Kenya documented the primary case of COVID-19 in March 2020, and by July 2021, there were 192,758 reported cases of COVID-19, with 3775 deaths (Ministry of Health [MoH], 2021). Although 50% of the COVID-19 deaths were associated with either DM or NCD, most deaths were reportedly associated with DM (Kiragu, et al., 2021). Currie et al. (2012) posits that a rise in mortality hazard was associated with increase in non-clinic attendance. The risk of high transmission of COVID-19 prompted a need to protect those living with other diseases. Globally, interventions to curb the spread of COVID-19 included hand washing, masking up, restrictions on gatherings, contact-tracing, home isolation, quarantine as well as COVID-19 vaccine.

"The health system structures comprise of health facilities established to regularly monitor individuals living with diseases, and thereby effect timely health interventions"

During the pandemic, DM patients were advised to have a 30-day insulin and other medical supplies (Gamble et al., 2020). Failed medical supply or delayed insulin delivery is detrimental to the health of MDII patients. Though the adoption of telehealth and tele pharmacy visits ensured minimal disruptions in utilization and medication, the need for in person visits was curtailed by distancing guidelines (Patel et al., 2021). Audio, video, or texting technology, though unpopular in most African countries, gained greater utility in communication between providers and their patients; thereby becoming a preferred mode of attending clinic and enabling those without complex devices to access healthcare (Assefa et al., 2021).

Diabetes Mellitus is a chronic disorder of metabolism characterized by chronic elevated blood sugar, arising from defects in insulin secretion. Its management calls for risk-reduction approaches beyond blood sugar control (Kaufman, 2012). Increasing DM burden and poor health outcomes has been on the rise in many developing countries due to poor disease knowledge and utilization of healthcare. There is therefore need to establish health systems that promote clinic availability in all seasons. A study by Fischer et al. (2020) indicated reduced Diabetes patient-visits to the hospitals during COVID-19 pandemic.

Health Systems Management (HSM) aims to ease healthcare access availability and affordability. The health system structures comprise of health facilities established to regularly monitor individuals living with diseases, and thereby effect timely health interventions. Management of diabetes aims to control blood sugar levels and. This is crucial in mitigating the risk of developing retinal neuropathy and nephropathy (Kharroubi & Darwish, 2015).

Problem statement

Management of Diabetes is commonly provided at specialty clinics situated in levels 2-5 public hospitals (MoH, 2015). Globally, diabetes prevalence stands at 463 million, 89% disease burden, and accounts for 4.2 million annual deaths (Bai et al., 2020). Diabetes population mainly comprise older persons with multiple comorbidities, hence the high vulnerability to COVID-19 adverse outcomes (Pugliese et al., 2020). Prevalence of COVID-19 prompted development of severe diseases, hospitalization in intensive care units and significant deaths among people living with DM II, with age as a dominant factor (Edqvist et al., 2021). Anecdotal information indicated that clinic attendance at the KCGH had declined from 1000 to 470 patients by July 2020.

The mortality rate of COVID-19 increased in Kenya, where 50% of COVID-19 mortalities reported to have suffered from Diabetes or a second NCD (Kiragu et al., 2021). This heightened the fear of loss of life among the vulnerable population. Initial reporting of COVID-19 was biased to counties proximal to Nairobi and inclusion of the rural counties only happened much later in 2020. The decline in DM clinic attendance at KCGH reported that DM related deaths and under reporting of COVID-19 prevalence in the county the gap that the study sought to fill. The study aimed to determine the influence of health service delivery structures and COVID-19 pandemic on the use of DM II clinic services I KCGH.

Study objective

Determine how factors related to health facility influenced utilization of DM II clinics during COVID-19 pandemic at KCGH.

Study question

How did factors related to health facility influence utilization of DM II specialty clinics during COVID-19 pandemic at KCGH?

Theoretical Framework

This study was supported by Andersen's Behavioral model of health services

utilization theory. The model demonstrates why people utilize health services, evaluates lack of equality in accessing health services; and indicates how people's use of these services inform policy development on equity in healthcare access. The framework examines an individual's use of healthcare services, factors that enhance use of healthcare services, and the perceived need for professional evaluated healthcare.

2.0 Materials and Methods

This study was conducted at the Kakamega County General Hospital (KCGH), a level 5 county referral institution selected because of the high volume of patients utilizing the facility's services. The study employed cross sectional survey study design to obtain quantitative and qualitative data. KCGH clinic records were used to target a population of 467 patients utilizing the clinic. The 211 sampled respondents were those who had utilized the clinic before and during COVID-19 pandemic. Inclusion criteria considered respondents above 18 years who had utilized services at the KCGH diabetes clinic prior to declaration of COVID-19 pandemic. The study excluded people who were attending different clinics within the same facility, and those who had not been utilizing diabetes clinic in pre-pandemic period; those who did not consent to interview; and those aged below 18 years. The sample size was achieved by employing Daniel sample size formula (Daniel, 1999) and adjusted it using the Yamane formula (1967).

Data was collected using structured questionnaire pretested at the Bungoma County Hospital, which exhibited similar socio-demographic and economic characteristics to those of KCGH. FGD was conducted during specialty clinic education day. Simple random sampling was used to identify respondents at the KCGH during scheduled clinic days. Quantitative data was analyzed using Statistical Package for Social Sciences - SPSS version 25- and results presented in tables.

Qualitative data was thematically aligned to respective study objectives and analyzed for convergence with findings of the descriptive and inferential statistics, and presented as excerpts. The chi-square test was applied to determine statistical independence between the variables and the logistic regression to establish the highest odds of clinic utilization. Ethical approval was obtained from KeMU Scientific and Ethical Review Committee, and a research permit granted by the National Commission for Science Technology and Innovation. KCGH provided the study license, while consent was sought from respondents before issuing questionnaires.

3.0 Results and Discussion

The study's pretest achieved a reliability coefficient of 0.81 Cronbach's alpha which is good. According to Cho and Kim, (2015), alpha is the best choice among all published reliability coefficients. The Cronbach alpha offers the thumb rules of: >0.9 being excellent, >0.8 as good, >0.7 as acceptable and >0.6 as questionable. The response rate for the structured questionnaire was 211(100%) and 6(75%) for FDG.

The operationalization of the outcome variable in this study was dichotomized as perfect clinic utilization at 100% attendance of clinic appointments or as non-perfect utilization at non-100% attendance of DM II clinics for the 12 clinics that informed the scope of the study. See Figure 1.

Figure 1

Utilization of DM type II clinic during the pandemic

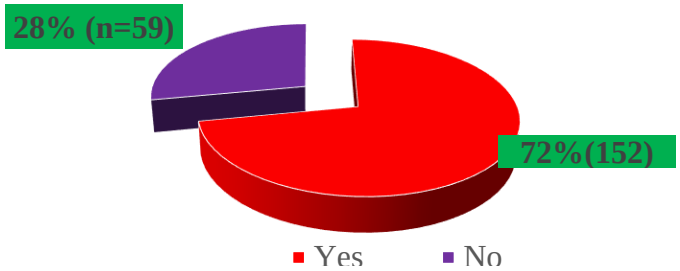

Figure 1 indicates that 152(72%) respondents utilized the clinic as scheduled, while 59(28%) skipped some scheduled appointments during the pandemic. The review of clinic utilization was between March 2021 to February 2022, a total of 12 months during the COVID-19 pandemic; with 4 peaks at an interval of about 3 months. The patient clinic attendance records revealed that July 2021 had an attendance of 1000 people, indicating both an optimized clinic attendance, and a DM prevalence in the county.

The study further investigated the number of clinic appointments skipped by each respondent. Table 1 shows the number of missed clinic appointments by the respondents.

Table 1

No of missed clinic appointments by the respondents (n=59)

No of times clinic appointments were missed	Frequency	%
1	21	35.6
2	10	16.9
3	13	22.0
4	7	11.9
5	4	6.8
6	1	1.7
8	2	3.4
12	1	1.7
Total	**59**	**100.0**

Table 1 depicts imperfect DM II clinic utilization by 59 (28%) respondents. Currie et al. (2012), determined a mortality hazard of (1.36–1.90) associated with clinic nonattendance for those missing two or more appointments.

Socio-demographic characteristics

The study established the mean age of the respondents with DM to be 62 years and median of 64 years. Studies confirm a similar mean age and indicates that the finding can partly be explained by fewer competing risks in young individuals, which reduces the perceived need for care (Poudel, 2021).

The study further analysed the demographic characteristics that influence the outcome variable as demonstrated in Table 2.

Table 2

Socio-demographic characteristics of respondents attending DM II specialty clinic

Characteristics		Frequency	%
Gender	Male	76	36
	Female	135	64
	Total	**211**	**100.0**
Marital Status	Married	148	70.1
	Single	11	5.2
	Widowed	8	22.7
	Separated	4	1.9
	Total	**211**	**100.0**
Religion	Christian	203	96.2
	Muslim	8	3.8
	Total	211	100.0
Highest level of Education	Primary	92	44.3
	Secondary	81	38.9
	Tertiary	35	16.8
	Total	**208**	**100.0**
Employment status	Formally employed	60	28.8
	Self employed	39	18.8
	Not employed	100	52.4
	Total	**208**	**100.00**

Results in Table 2 indicated that 135(64%) respondents were female 148(70.1%) were married while 109(52.4%) were not formally employed. Most respondents reported more clinic utilization during the COVID-19 pandemic. This finding may mirror the life

expectancy status in Kenya that stands at 64 and 59 years for female and males respectively (KDSH 2022). Further, the finding indicates that moral and financial support from spouses resulted in superior clinic attendance by married respondents.

Facility-related factors that influence utilization of DM II specialty clinic.

The second objective sought to establish influence of facility-related factors on DM II utilization during the COVID-19 pandemic as indicated in Table 3.

Table 3

The Influence of facility related factors on DM II clinic utilization during COVID-19 pandemic

Facility related factors		Frequency	%
It was easy to get my usual supply of medicines during lockdown.	Yes	102	48.3
	No	109	51.7
	Total	211	100.0
There is provision for hand washing facilities at the clinic all the time.	Yes	211	100.0
	No	00	0
	Total	211	100.0
The facility management advised me to attend the clinic if I had an emergency	Yes	205	97.2
	No	6	2.8
	Total	211	100.0
The waiting time for service at the specialty clinic during this pandemic is long.	Yes	42	19.9
	No	169	80.1
	Total	211	100.0
The number of HCW has been low compared to pre-pandemic.	Yes	52	24.6
	No	159	75.4
	Total	211	100.0
The clinic remained in operation throughout the pandemic period.	Yes	178	84.4
	No	33	15.6

The results in Table 3 reveal that most 109(51.7%) respondents did not find it easy to get their usual supply of medication during COVID-19 pandemic, supporting findings which indicated undesirable impact on of COVID-19 on both the scheduled clinic visits and the supply of medications (Shimels et al., 2021). This finding is corroborated by Barone who found out that 38.4% of respondents with DM postponed their medical appointments to the health facilities during the pandemic (Barone et al., 2020). The study established a convergence of medicine unavailability for a significant period of the COVID-19 pandemic as expressed in the following excerpt:

> *"The patients would come for their scheduled clinics but after review, we would ask them to go and buy medicines from private chemists*

because there were no supplies from late 2020 to mid-2021. Sadly, NHIF does not cover medication supply by private chemist" (FGD\Female \01).

Bivariate analysis of factors that influence clinic adherence among the respondents.

The study further sought to establish the statistical independence between the dependent variable; namely, utilization of DM II specialty clinics, and exposure variables by subjecting the variable of facility, patient, disease related factors, and COVID-19 restrictions to the chi-square test for association. The findings are shown in Table 4.

Table 4

Relationship between independent variable and the DM II clinic utilization

Factors influencing clinic Utilization		Attended all appointments				N	Chi square
		Yes		No			
		n	%	n	%		
Family not afraid that I would contract Covid-19	Yes	33	21.7	30	50.8	63	χ^2=17.229
	No	119	78.3	29	49.2	148	df=1,
	Total	**152**	**100**	**59**	**100**	**211**	**p=<0.001**
Was easy to get my medications	Yes	84	55.3	18	30.5	102	χ^2=10.430
	No	68	44.7	41	69.5	109	df=1,
	Total	**152**	**100**	**59**	**100**	**211**	**p=0.001**
Fear of visiting facility	Yes	46	30.3	28	47.5	74	χ^2=5.518
	No	106	69.7	31	52.5	137	df=1,
	Total	**152**	**100**	**59**	**100**	**211**	**p=0.019**
Clinic remained open during Covid-19 pandemic	Yes	133	87.5	45	76.3	178	χ^2=4.062
	Yes	133	87.5	45	76.3	178	df=1,
	Yes	**133**	**87.5**	**45**	**76.3**	**178**	**p=0.044**
Age of respondent	>65 yrs	78	51.3	38	64.4	116	χ^2=4.219
	<65 yrs	74	48.7	21	35.6	95	df=1,
	Total	**152**	**100.0**	**59**	**100.0**	**211**	**p=0.040**

Table 4 demonstrates that perceived ease of obtaining medicines, and family not being afraid that the respondent would contract COVID-19 at the MD II clinic were statistically significant at p< 0.05. These findings were corroborated by Barone et al. (2020) who stated that patients faced difficulties in getting medical supplies during the COVID-19 pandemic.

Multivariate analysis of factors that influence clinic utilization among the respondents.

This study further investigated the odds that a respondent would have to perfect clinic utilization at any given point by conducting logistic regression analysis.The model fit test eliminated the statistically significant omnibus test ($\chi^2 = 34.873$, df=10, p= < 0.001) and Cox & Snell R Square and Nagelkerke R Square value whose variation was below 30% prediction. The Hosmer Lemeshow test (χ^2=7.038, df=8, p=0.533), showed that the p value was not statistically significant, making it a good model fit for the study.

The study subjected 10 variables to the test based on their significance at bivariate level, and secondly their contribution to clinic utilization as indicated in Table 5.

Table 5

Logistic Regression model for ten significant variables

	β	S.E.	Wald	Sig.	OR	95% C.I	
						Lower	Upper
Family being afraid I could get Covid-19 in the clinic	-1.327	0.471	7.927	0.005	0.265	0.105	0.668
Easy to get usual supplies of medicine	0.832	0.371	5.028	0.025	2.297	1.11	4.753
Age (Categorical)	-0.82	0.376	4.765	0.029	0.441	0.211	0.92
Good control of diet	0.828	0.434	3.65	0.056	2.29	0.979	5.356
HCW call when care is missed	-0.654	0.369	3.144	0.076	0.52	0.252	1.071
Gender	-0.481	0.379	1.611	0.204	0.618	0.294	1.299
Level of education	-0.33	0.292	1.273	0.259	0.719	0.405	1.275
Employment status	-0.209	0.241	0.747	0.388	0.812	0.506	1.303
Having a family member who contracted Covid-19	-0.349	0.433	0.65	0.420	0.705	0.302	1.648
Constant	3.035	2.058	2.176	0.140	20.806		

The analysis in Table 5 indicated that an increase in medication variable was associated with 130% odds (2 times more likelihood) of clinic utilization by respondent during the pandemic (β=0.832, OR= 2.297, p=0.025, 95% CI=1.11- 4.753). This finding reinforces the conclusion of the study that confirmed lower access to essential medicines during the COVID-19 pandemic compared to prior period; thereby, worsening

the chronic conditions for patients (Tuczyńska et al., 2021).

4.0 Conclusion

Utilization of healthcare is an outcome of a mixed demand-supply framework modelled by need, predisposition, and enabling factors. The study explored how health facility-related factors influenced the use of non-emergency services. Analysis of the factors has demonstrated challenges in accessing regular anti-diabetes treatment occasioned by drug stock shortages at the health facility with the patients being directed to buy from private pharmaceutical shops. The finding had convergence with qualitative information, and was in tandem with findings of studies which established disruption in accessing medicines and other outpatient services across the globe during the pandemic. Notably, imperfect clinic utilization was significant at 28%. The study established the highest odds of clinic utilization of β=0.832, OR= 2.297, p=0.025 associated with ease of obtaining medication, and the least odds of clinic utilization associated with lack of family support. The study provides empirical evidence for policy review on the management of future pandemics in relation to the aspect of availability as a component of access to health services by county and national health ministries, with a bias to rural county health ministries.

5.0 Recommendations.

The study recommends KCGH superintendent to work with the healthcare officer in charge of Diabetes Specialty Clinic and Kakamega County health ministry in developing strategy and implementation policy on hybrid clinic visits. This would provide for quarterly HbA1c checks, and frequent telemedicine visits and surveillance. Secondly, KCGH superintendent should collaborate with the county MoH and national MoH, to establish uninterrupted medicines and commodity supply for the rural population living with NCDs, to avoid biased priority in distributing emergency supplies during pandemics. Thirdly, the County government should develop a strategy to address the negative influence of socioeconomic and demographic factors such as age, gender and employment supported on the access of health services during pandemics.

References

Assefa, N., Sié, A., Wang, D., Korte, M. L., Hemler, E. C., Abdullahi, Y. Y., & Oduola, A. (2021). Reported barriers to healthcare access and service disruptions caused by COVID-19 in Burkina Faso, Ethiopia, and Nigeria: A telephone survey. The American *Journal of Tropical Medicine and Hygiene*, *105*(2),3 23-330. https://doi.org/ 10.4269/ajtmh.20-1619

Bai,Y., Yao, L., Wei, T., Tian, F., Jin, D. Y., Chen, L., & Wang, M. (2020). Presume asymptomatic carrier transmission of COVID-19. *American Medical Association*, *323*(14),1406-140. https://doi: 10.1001/jama.2020.2565

Barone, M. T. U., Harnik, S. B., de Luca, P. V., de Souza Lima, B. L., Wieselberg, R. J. P., Ngongo, B., ... & Giampaoli, V. (2020). The impact of COVID-19 on people with diabetes in Brazil. *Diabetes research and clinical practice, 166*,1-9. https://doi.org/ 10.1016/j.diabres.2020.108304

Cho, E., & Kim, S. (2015). Cronbach's coefficient alpha: Well-known but poorly understood. Organizational Research Methods, 18(2), 207-230. https://doi.org/10.1177/1094428114555994

Currie, C. J., Christopher Ll. M., Poole, C. D., Jenkins-Jones, S., Rubin, R. R., Burton, C. M., & Evans. M. (2012). The Impact of Treatment Noncompliance on Mortality in People with Type 2 Diabetes. *Diabetes Care, 35*(6), 1279– 1284. https://doi.org/10.2337/dc11-1277

Daniel, W.W. (1999). Biostatistics: A Foundation for Analysis in the Health Sciences. (7th ed.). John Wiley & Sons.

Edqvist, J., Lundberg, C., Andreasson, K., Pigi Dikaiou, L. K., Ludvigsson, J., Lind, M., Adiels, M., & Rosengren, A. (2023). Severe COVID-19 Infection in Type 1 and Type 2 Diabetes During the First Three Waves in Sweden. *Diabetes Care, 46* (3), 570–578. https://doi.org/10.2337/dc22-1760

Fischer, S.H., Uscher-Pines, L., Roth, E. & Breslau, J. The Transition to Telehealth during the First Months of the COVID-19 Pandemic: Evidence from a National Sample of Patients. *Journal of General Internal Medicine, 36*(3), 849–851). https://doi.org/10.1007/s11606-020-06358-0

Gamble, A., Pham, Q., Goyal, S., & Cafazzo, J. A. (2020). The challenges of COVID19 for people living with diabetes: Considerations for digital health. *JMIR diabetes, 5*(2), e19581. https://doi.org/10.2196/19581

Kaufman, F. R. (Ed). (2012). *Medical Management of Type 1 Diabetes*. American Diabetes Association.

Kenya National Bureau of Statistics and ICF. (2023). Kenya Demographic and Health Survey 2022. Key Indicators Report. Nairobi, Kenya, and Rockville, Maryland, USA: KNBS and ICF.

Kiragu, Z. W., Gathecha, G., Mwangi, M. K., Ndegwa, Z., Pastakia, S., Nyagah, D., Cizungu, R. N., Takah, Mutwiri, M., Ndolo, M., & Wirtz, V.J. (2021). Access to Medicines for Non-Communicable Diseases (NCDS) during COVID-19 in Kenya: A Descriptive Commentary. *Health Systems Reform, 7*(1), 1-8. https://doi.org/10.1080/23288604.2021.1984865

Kharroubi, A. T., & Darwish, H. M. (2015). Diabetes mellitus: The epidemic of the century. *World journal of diabetes, 6*(6), 850-67. https://doi: 10.4239/wjd.v6.i6.850

Ministry of Health. (2014). Kenya Health Policy 2014-2030: Towards attaining the highest standard of health. http://publications.universalhealth2030.org/uploads/kenya_health_policy_2014_to_2030.pdf

Ministry of Health. (2015). Kenya STEPwise Survey for Non-Communicable Diseases Risk Factors 2015. (Report). http://www.nutritionhealth.or.ke/wpcontent/uploads/Downloads/Kenya%20STEPwise%20Survey%20for%20Non-Communicable%20Diseases%20Risk%20Factors%20Report%202015

Ministry of Health. (2021). Guidelines on Management of COVID-19 in Kenya. https://healthsciences.uonbi.ac.ke/sites/default/files/2021- 81 10/Final%20GUIDELINES%20ON%20THE%20MANAGEMENT%2001-09- 21.pdf

O'Donnell, O. (2007). Access to health care in developing countries: breaking down demand side barriers. *Cad Saude Publica, 23*(12), 2820-34. https://doi.org/10.1590/s0102-311x2007001200003

Patel, S.Y., Rose, S., Barnett, M.L., Huskamp, H.A., Uscher-Pines, L., & Mehrotra A. Community Factors Associated with Telemedicine Use During the COVID-19 Pandemic. (2021). *JAMA Network Open. 4*(5), e2110330. https://doi.org/10.1001/jamanetworkopen.2021.10330

Poudel, A.N., Zhu, S., Cooper, N., Roderick, P., Alwan, N., Tarrant, C., Ziauddeen, N., & Yao, G.L. (2021). Impact of Covid-19 on health-related quality of life of patients: A structured review. *PLoS One, 16*(10), e0259164. https://doi.org/10.1371/journal.pone.0259164

Pugliese, G., Vitale, M., Resi, V., & Orsi, E. (2020). Is diabetes mellitus a risk factor for Corona Virus Disease 19 (COVID-19)?. *Acta Diabetol, 57*(11), 1275-1285. https://doi.org/10.1007/s00592-020-01586-6

Shimels, T., Asrat Kassu, R., Bogale, G., Bekele, M., Getnet, M., Getachew, A., & Abraha, M. (2021). Magnitude and associated factors of poor medication 83 adherence among diabetic and hypertensive patients visiting public health facilities in Ethiopia during the COVID-19 pandemic. *PloS one, 16*(4), e0249222. https://doi.org/10.1371/journal.pone.0249222

Tuczynska, M., Matthews-Kozanecka, M., & Baum, E. (2021). Accessibility to Non COVID Health Services in the World During the COVID-19 Pandemic. *Frontiers in Public Health, 9,* 1-7. https://doi.org/10.3389/fpubh.2021.760795

World Health Organization. (2007). Everybody's business: Strengthening health systems to improve health outcomes: WHO'S framework for action. Key components of a well-functioning health system. WHO Press. https://iris.who.int/handle/10665/43918

Yamane, T. (1973). *Statistics: An Introductory Analysis*. John Weather Hill, Inc.