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Effects of COVID 19 on Hospitalization Rate Among Diabetic People in Brazil

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Abstract

The study sought to examine the effects of COVID 19 on the hospitalization rate among diabetic people in Brazil. The study made conclusions based on the findings from the previous studies. The study findings indicated that People with diabetes are more likely to have severe complications from COVID-19. People with diabetes are more likely to have symptoms and complications when infected with any virus, but COVID 19 has been extreme. Individuals with persistent diseases like diabetic Mellitus, weight problems, hypertension, or cardiovascular cases are the most affected by COVID-19. Diabetic Mellitus is a severe problem that requires self-management and more disciplinary attention that consists of regular care to diet, exercise, blood sugar management and use of drugs. It is concluded that Patients with diabetes have been greatly affected by the COVID-19. The hospitalization rate has been high among patients that have diabetes. COVID-19 pandemic has led to health service modification and temporary disruption of the routine care provided to patients with diabetes mellitus (DM) in primary care. This is done to minimize outpatient visits, permit physical distancing, and ensure patients' and healthcare providers' safety. The study recommended that different measures to prevent COVID-19 are crucial for individuals with diabetes. People with diabetes need regular blood sugar management and compliance with ongoing medication, even when it comes to COVID-19 infection. It is important to remember that people with either type of diabetes can vary in age, their complications, and how well they have managed their diabetes. The government needs guidelines to guarantee accessibility to medicines and healthcare services among diabetic patients.

Keywords: *Covid 19, hospitalization rate, diabetic people, Brazil*

1.0 Introduction

COVID-19 usually spreads quickly within a short period (Català, Alonso, Alvarez-Lacalle, López, Cardona & Prats, 2020). When it was discovered in Hubei, China, it took a short period to spread into many nations of the world, affecting more than 6 million people and leading to over 6,000,000 fatalities. By June 2020, significabnt cases were recorded in Brazil. In Brazil, early precautions were not taken, and due to that, the disease spread rapidly in the country and became one of the most affected globally in both the new infection cases and death rates (Liu, Chen, Liu, Nie & Lu, 2020). Nearby nations reacted quickly and strictly, where lockdowns began in Uruguay, followed by several other neighboring countries, and lasted relatively longer than planned. Individuals with persistent diseases like diabetic Mellitus (DM), weight problems, hypertension, or cardiovascular cases were the most affected by COVID-19 (Önmez, Gamsızkan, Özdemir, Kesikbaş, Gökosmanoğlu, Torun & Cinemre, 2020). Individuals with diabetes have a high probability of worsening their comorbid conditions, and as a result, they pass away, contrasted to those without morbidity. Additionally, various researches recommend that lack of glycaemic control enhances the risk of unwanted effects in diabetes.

According to Abdoli, Silveira, Doosti-Irani, Fanti, Miller-Bains, Pavin, and Hessler (2021), Brazil has over 16.8 million residents have diabetic issues (20.1% of the residents 19-65 years); being among the five nations in the number of people with diabetic Mellitus as there is proof that around 55% of them did not know if they are affected by the disease. Furthermore, information on glycaemic regulation in Brazil reveals that just a small number (around 30%) attained the therapeutic target of glycated hemoglobin (HbA1c) < 8% before the outbreak of the disease, as advised by the Brazilian diabetic society (Van Baar, Holleman, Crenier, Haidry, Magee, Hopkins & Bergman, 2020). The global advice on the guidelines of social distancing for prevention of COVID-19 primarily focused on vulnerable individuals, together with those with diabetic Mellitus. Diabetic Mellitus is a severe problem that requires self-management and more disciplinary attention that consists of regular care to diet, exercise, blood sugar management and use of drugs (Kaplan Serin & Bülbüloğlu, 2021). Furthermore, resilience is regarded as overcoming negative situations, whereby the person is strengthened or changed by them. Different researches indicate a positive relationship between resilience and adequate care for diabetic Mellitus.

COVID-19 disease brought about severe changes in the healthcare sector and short-term changes in the regular treatment given to people with diabetes in medical facilities (Biancalana, Parolini, Mengozzi & Solini, 2021). These changes were done to reduce the outpatient visits, allow social distancing, and ensure patient and doctor safety. No proof explored or evaluated the effect of COVID-19 disease on diabetes mellitus series and individual glycemic results. Diabetic people are at a higher risk than those with viral or bacterial infections (Erener, 2020). The immune system compromised by the metabolic pathology is characterized by a minimized feedback and effectiveness of neutrophil and T-lymphocyte activity and by the absence of a sufficient humoral immune response that puts the individual with diabetic issues at higher risk of viral or microbial infection, particularly in the respiratory tracts. Diabetic individuals are at a higher risk of COVID-19 disease and increased problems and death. Different measures to prevent COVID-19 are crucial for individuals with diabetes (Mantovani, Byrne, Zheng & Targher, 2020).

People with diabetes require regular blood sugar management and compliance with ongoing medication, even when it comes to COVID-19 infection. For people with severe COVID-19

diabetes, medications like gliptins, incretin mimetics, or sodium-glucose co-transporter-2 preventions may safely continue to be considered, and ace inhibitors/angiotensin receptor blocker antihypertensives must also continue to be considered unless contraindications or more proof concerning their usage arises. Specifically, the person who has diabetes has a high risk of dying of pneumonia than the other people without such a condition (Oriot & Hermans, 2022). Additionally, throughout the SARS-CoV epidemic in 2003, identical to COVID-19, diabetes was noted as a risk factor for mortality from infection. In a similar pandemic, like Middle East respiratory system syndrome, the cases of diabetes were a risk factor for disease and severe problems. Similarly, among individuals with influenza A in 2010, diabetes raised the risk of complications. Individuals with diabetes are not more likely to get the virus than others. However, if they contract COVID-19, individuals with diabetes are more probably to have severe difficulties and become seriously ill from COVID-19 than those that do not have diabetes (Smith, Boppana, Traupman, Unson, Maddock, Chao & Connor, 2021). If an individual with diabetes contracts COVID 19, they are highly vulnerable to severe form of COVID-19 and is most likely to pass away than those without diabetes.

2.0 Literature review

Ballivian, Alcaide, Cecchini, Jones, Abbamonte and Cassetti (2020) conducted a study to examine the impact of COVID 19 on people with diabetes. In a convenience sampling study, information was gathered from 2458 people, 20 years and above; 80.47%-woman respondents; 59.48% T1D and 28.58% T2D, between May 15th and June 8th, making use of an anonymous and untraceable study comprising 15 multiple selection inquiries (socio-demographic; health condition and behaviors of life throughout COVID-19 pandemic). The study findings indicate that People with diabetes are more likely to have severe complications from COVID-19. People with diabetes are more likely to have more severe symptoms and complications when infected with any virus. Their behaviors usually changed, which affected their glycemia, potentially enhancing the risk of poor results and mortality if infected by SARS-CoV-2 and of severe and persistent diabetic issues. COVID-19 is a more severe illness than seasonal flu in everyone, including people with diabetes. All of the standard precautions that have to be followed to avoid infection that has been widely reported are even more important when dealing with this virus. The importance of following up with individuals in the health care services, implying that telemedicine must be increased, and assistance offered for adaptation in the view of the therapeutic challenges. New methods were needed to monitor the behavior of diabetic issues in the lasting concerning self-care and strength with the development of the COVID-19 pandemic. COVID-19 pandemic has led to health service modification and temporary disruption of the routine care provided to patients with diabetes mellitus (DM) in primary care.

Deepa, Parveen, Khurshid, Ramachandran, Sathiyaraj and Vimala (2022) researched the political measures taken to combat COVID-19 in the North American continent while protecting people with diabetic problems. A study with 20 inquiries was distributed to all IDF member institutions in 9 nations. A descriptive evaluation was executed and a multivariate cluster evaluation strategy pam (segmenting around medoids) was used. 2 teams of nations were determined. The initial group noted much more challenges (challenges in accessing primary or health requirements) and issues (problems about the effect of the pandemic), many nations with more rigorous approaches to combat the spread of the infection. In contrast, many of the 2nd team included nations with few

restriction measures and noted reduced challenges. Only 40% reacted that a measure was implemented to secure people with diabetes delivering their medications and materials at home (20%) or receiving medication and materials which could take them for 4-5 months (31%). All participants discovered that one of the significant fears was contamination, not receiving enough medication and getting infected if visiting the healthcare facility or clinical consultations. Most North American nations do not have timely procedures to secure people with diabetic issues, which might bring about the present and future severe effects on the people, health system and economy.

According to Vickery, Novotny, Ford, Lantz, Kavistan, Singh and Wieland (2022) argued that worldwide measures on the issue of physical distancing for combating COVID-19 had transformed the day-to-day routine of a large section of the residents, and these might affect the treatment and resilience with diabetes throughout scenarios of difficulty. The research aimed to examine the characteristics of diabetic people and self-care methods and stability with diabetes in the case of the COVID-19 pandemic in China. This is a cross-sectional web survey conducted among adults with diabetes. An organized 39-item set of questions was carried out on the REDCap platform, consisting of the Diabetes Self-Care Activities Survey and Connor-Davidson Resilience Range, to gauge socio-demographic and clinical characteristics. The internet study was shared with the major social networks and information was accumulated from October 2nd to November 20th, 2020. Data evaluation was done according to the kind of diabetic Mellitus. Out of the 2501 respondents, 70.4% were females, 39.5% were aged between 29 and 60 years of age, 71.5% stayed in the north-western region of China, 60.4% had master's degrees, 51% noted to have DM1 and 250 individuals reported to have had COVID-19. Diabetic treatment mostly entailed the use of medications (89%), whereas the least used ones were physical activity (32.4%) and examination of the shoes (40.2%). Around 38% of the individuals were followed up by telemedicine, 59.5% monitored their glycaemic levels, 58.6% used a balanced diet, and 39.5% left the house to visit the marketplace and drugstore. The mean resilience was 31.1(SD=8.9). In China, diabetic people adhere to physical distancing and maintain their medical treatment for diabetic Mellitus. Nevertheless, the practice of physical activity and foot assessment was not adhered to by the people with a low level of resilience. These results indicated the significance of patient follow-up in the medical care services, suggesting that telemedicine should be enhanced and assistance given for adjustment because of the therapeutic setbacks.

Sheng, Chen, Wei, Yue, Chu, Zhao and Zhang (2020) discovered that the worldwide pandemic SARS-CoV-2 (COVID-19) is creating countless fatalities worldwide and is among the most major health obstacles ever encountered in human history. SARS-CoV-2 infection may trigger deadly lung problems started by a generalized inflammatory state related to multiple organ dysfunction. In the study, it is vital to identify the variables that increase the viral infection risk. Individuals with prior problems, like diabetic issues, are at a higher risk of pests and fatality brought about by COVID-19. Old age, possible persistent medication therapies, kidney failure, hyperglycemia, and heart disease, are predictive factors of a negative result for the diabetic person. The control of glycemia and the usage of proper actions are essential factors to be considered for the diabetic individual during these pandemic times, particularly in the person with the persistent infection. Lastly, drugs used to fight COVID-19 infection, like antivirals or immunomodulators, need to be well regulated to prevent possible drug interactions and significant problems. Individuals with diabetic issues lie under the class of delicate and at-risk people. If a COVID-19 infection goes on, the person needs to be taken care of efficiently, attempting to combat the virus without putting

aside homeostasis and glycemic regulation. The evaluation shows the present knowledge and obstacles to preventing and managing diabetic people and COVID-19 infection.

Ludwig and Zarbock (2020) study reported that COVID-19 is a disease caused by the coronavirus SARS-CoV-2, which is regarded as a highly transmittable disease, presently affecting over 198 nations globally. The primary symptom of SARS-CoV-2, which differentiates it from the other viruses and its transmission rate, is high and a higher risk of death from acute respiratory distress disorder. Diabetic individuals with extreme obesity, cardiovascular disease, and high blood pressure have high chances of getting infected and are at a higher risk of death due to COVID-19. Older adults are at higher risk of death from COVID-19; 32.4% are diabetic. Even though the factors for these increased risks are yet to be figured out, numerous aspects might lead to type-2 diabetic individuals' increased vulnerability to other infections. A possible part that might raise the risk in individuals affected by diabetes and excessive weight is the impaired natural and adaptive immune action, identified by a state of severe and low-grade inflammation, which may result in sudden systemic metabolic alteration. SARS people formerly diagnosed with diabetes mellitus or hyperglycemia had higher death rates when contrasted with those that are under metabolic regulation. Similarly, obese people are at a higher risk of experiencing difficulties from SARS-CoV-2. The study examined the present and developing insights essential to the metabolic influence of coronavirus disease with a unique focus on the primary paths and mechanisms connected to the pathophysiology and treatment of diabetes mellitus.

Garg, Rodbard, Hirsch and Forlenza (2020) examined the availability of diabetic services in health care after the outbreak of the COVID-19 pandemic and step individuals' glycemic results. Before and after, retrospective research utilizing Al-Shifa medical care database in health care. Two thousand grown-up individuals with diabetic issues who participated in the diabetic clinic before the pandemic in 2019 were arbitrarily picked and followed up until the end of 2020. Those over 18 years and at least two visits in 2019 were included. Accessibility to diabetic services was recognized by different people who received care, frequency of assessments, mode of assessment, and intervention provided to individuals. People's glycated hemoglobin (HbA1c) and other glycemic factors after the pandemic in 2020 were established and contrasted to the same factors before the pandemic in 2019. The relationship between patients' HbA1c and mode of assessment was determined utilizing multivariable regression analysis. One thousand five hundred eighty patients remained to comply and obtained DM treatment after the pandemic. The median number of assessments was 3, with an interquartile range: of 4-3. 61.2% had face-to-face only, 29.7% had a mix of face-to-face and telephone examinations, and 9% had telephone examination only. Mean distinction in HbA1c (%) prior to and after pandemic was 0.3 ±2.5 (95% CI: 0.1 to 0.3), P=.003. There was a general improvement in mean glycated hemoglobin; moreover, it was fewer than 2-point improvement. After readjusting for multivariable, glycated hemoglobin was minimized within those that received examination consisting of telephone assessment contrasted to those that didn't, nevertheless, the proof was unconvincing.

Gujral, Johnson, Nielsen, Vellanki, Haw, Davis and Pasquel's (2020) research discovered an improvement in the severity of coronavirus disease, brought on by infection with severe acute respiratory system syndrome coronavirus 2, in diabetic people. Additionally, COVID-19 may further predispose infected people to hyperglycemia. Engaging with various other risk aspects, hyperglycemia may regulate immune and inflammatory reactions, hence predisposing individuals

to serious COVID-19 and possibly dangerous results. Angiotensin-converting enzyme 2, a section of the renin-angiotensin-aldosterone system, is the primary entry receptor for SARS-CoV-2, even though dipeptidyl peptidase four may likewise work as a binding target. Initial data, nonetheless, do not recommend a substantial impact of glucose-decreasing DPP4 preventions on SARS-CoV-2 vulnerability. Owing to their pharmacological features, sodium-sugar cotransporter two preventions may lead to adverse effects in people with COVID-19; therefore, it cannot be suggested. Presently, insulin should be the primary technique for regulating intense glycemia. Readily available proof does not differentiate between the main types of diabetic Mellitus and is associated with type 2 diabetic Mellitus owing to its high occurrence. Moreover, minimal evidence is currently present on type 1 diabetic Mellitus and COVID-19. Most of these conclusions are preliminary, and even more examination of the optimum management in individuals with diabetes mellitus is necessitated.

A study by Bajgain, Badal, Bajgain and Santana (2021) argued that diabetes is one of the leading regularly reported comorbidities in people infected with COVID-19. As per the information, people with diabetes do not seem to be at a higher risk of having SARSCoV-2 than others. Diabetes mellitus is a dangerous factor for creating serious and vital types of COVID-19. The latter needs admission to a high dependency unit and invasive mechanical ventilation, with more cases of death rates. The features of a diabetic person at risk of developing severe and vital types of COVID-19, in addition to the prognostic effect of diabetes on the course of COVID-19, are under examination. Weight problems, the primary risk element for incident type 2 diabetes, is primarily common in people with critical types of COVID-19 needing invasive mechanical air flow. COVID-19 is generally related to a lack of glycemic regulation and a greater risk of ketoacidosis in a person with diabetes. There are presently no suggestions in favor of stopping antihypertensive medicines interacting with the renin-angiotensin-aldosterone system. Metformin and SGLT2 inhibitors should be contained in individuals with extreme types of COVID-19 owing to the risks of lactic acidosis and ketoacidosis. Ultimately, it is recommended for systematic testing for (pre)diabetes mellitus in individuals with proven COVID-19 infection.

Kazakou, Lambadiari, Ikonomidis, Kountouri, Panagopoulos, Athanasopoulos and Mitrakou (2022) discovered a bidirectional interaction between Diabetes mellitus and COVID-19. Diabetic individuals are at greater risk of fatal or vital care unit-treated COVID-19 and COVID-19 relevant health challenges contrasted to people without diabetes mellitus. Clinical information until now advises that the severe acute respiratory disorder coronavirus 2 (SARS-CoV-2) might cause metabolic dysregulation and damaged glucose homeostasis. Additionally, data on new beginning DM in formerly infected with SARS-CoV-2 people strengthen the hypothesis of a direct impact of SARS-CoV-2 on glucose metabolism. Attempting to discover the wrongdoer, it is now recognized that the pancreatic and the endothelium have been found to express the Angiotensin-converting enzyme two receptors, the primary binding site of the virus. To move from place to place, comprehending the impacts of COVID-19 on metabolism and glucose homeostasis is essential to stop and handle difficulties associated with COVID-19 and assist recovering individuals. In the study, we evaluate the prospective underlying pathophysiological mechanisms between COVID-19 and glucose dysregulation along with the impacts of antidiabetic treatment in individuals with diabetes mellitus and COVID-19.

3.0 Research Findings and Conclusion

The study findings indicate that People with diabetes are more likely to have severe complications from COVID-19. People with diabetes are more likely to have more severe symptoms and complications when infected with any virus. Individuals with persistent diseases like diabetic Mellitus, weight problems, hypertension, or cardiovascular cases are the most affected by COVID-19. Diabetic Mellitus is a severe problem that requires self-management and more disciplinary attention that consists of regular care to diet, exercise, blood sugar management and use of drugs. People with diabetes need regular blood sugar management and compliance with ongoing medication, even when it comes to COVID-19 infection. For people with diabetes, knowing about their more significant risk, mainly when presenting glycemic levels out of the target, protective guidelines and techniques to facilitate optimal self-care should be used. In Brazil, patients with diabetes throughout the COVID-19 pandemic period noted that they followed the physical distancing guidelines and maintained the treatment with diabetes, but they minimized the practice/exercise, along with a reduced level of resilience. Among the diabetic people, there was a statistically substantial difference between all variables regarding self-care and resilience.

It is concluded that Patients with diabetes have been greatly affected by the COVID-19. The hospitalization rate has been high among patients that have diabetes. COVID-19 is a more severe illness than seasonal flu in everyone, including people with diabetes. All of the standard precautions that have to be followed to avoid infection that has been widely reported are even more important when dealing with this virus. The importance of following up with individuals in the health care services, implying that telemedicine must be increased, and assistance offered for adaptation in the view of the therapeutic challenges. New methods were needed to monitor the behavior of diabetic issues in the lasting concerning self-care and strength with the development of the COVID-19 pandemic. COVID-19 pandemic has led to health service modification and temporary disruption of the routine care provided to patients with diabetes mellitus (DM) in primary care. This is done to minimize outpatient visits, permit physical distancing, and ensure patients' and healthcare providers' safety.

4.0 Recommendations

The study recommended that different measures to prevent COVID-19 are crucial for individuals with diabetes. People with diabetes require regular blood sugar management and compliance with ongoing medication, even when it comes to COVID-19 infection. It is important to remember that people with either type of diabetes can vary in age, complications they have developed and how well they have managed their diabetes. People who already have diabetes-related health problems are likely to have worse outcomes if they contract COVID-19 than people with diabetes who are otherwise healthy, whichever type of diabetes they have. The government needs to quickly change this case, executing guidelines to guarantee accessibility to medicines and healthcare services, using telehealth, teleconsultations and medicines delivery choices whenever possible. These are not just techniques to minimize the burden on people and the whole population but also a way to prevent health systems collapse.

REFERENCES

Abdoli, S., Silveira, M. S., Doosti-Irani, M., Fanti, P., Miller-Bains, K., Pavin, E. J., ... & Hessler, D. (2021). Cross-national comparison of psychosocial well-being and diabetes outcomes in adults with type 1 diabetes during the COVID-19 pandemic in US, Brazil, and Iran. *Diabetology & metabolic syndrome*, 13(1), 1-12. https://doi.org/10.1186/s13098-021-00681-0

Bajgain, K. T., Badal, S., Bajgain, B. B., & Santana, M. J. (2021). Prevalence of comorbidities among individuals with COVID-19: A rapid review of current literature. American *Journal of Infection Control*, 49(2), 238-246. https://doi.org/10.1016/j.ajic.2020.06.213

Ballivian, J., Alcaide, M. L., Cecchini, D., Jones, D. L., Abbamonte, J. M., & Cassetti, I. (2020). Impact of COVID-19-related stress and lockdown on mental health among people living with HIV in Argentina. *Journal of Acquired Immune Deficiency Syndromes*, 85(4), 475-482. https://doi.org/10.1097/QAI.0000000000002493

Biancalana, E., Parolini, F., Mengozzi, A., & Solini, A. (2021). Short-term impact of COVID-19 lockdown on metabolic control of patients with well-controlled type 2 diabetes: a single-centre observational study. *Journal of Acta* diabetologist, 58(4), 431-436. https://doi.org/10.1007/s00592-020-01637-y

Català, M., Alonso, S., Alvarez-Lacalle, E., López, D., Cardona, P. J., & Prats, C. (2020). Empirical model for short-time prediction of COVID-19 spreading. Plos computational biology, 16(12), 431-449. https://doi.org/10.1371/journal.pcbi.1008431

Deepa, N., Parveen, A., Khurshid, A., Ramachandran, M., Sathiyaraj, C., & Vimala, C. (2022, May). A study on issues and preventive measures taken to control Covid-19. In AIP Conference Proceedings (Vol. 2393, No. 1, p. 020226). AIP Publishing LLC. https://doi.org/10.1063/5.0075078

Erener, S. (2020). Diabetes, infection risk and COVID-19. Molecular metabolism, 39, 101044. https://doi.org/10.1016/j.molmet.2020.101044

Garg, S. K., Rodbard, D., Hirsch, I. B., & Forlenza, G. P. (2020). Managing new-onset type 1 diabetes during the COVID-19 pandemic: challenges and opportunities. *Diabetes technology & therapeutics*, 22(6), 431-439. https://doi.org/10.1089/dia.2020.0161

Gujral, U. P., Johnson, L., Nielsen, J., Vellanki, P., Haw, J. S., Davis, G. M., ... & Pasquel, F. J. (2020). Preparedness cycle to address transitions in diabetes care during the COVID-19 pandemic and future outbreaks. *BMJ Open Diabetes Research and Care*, 8(1), e001520. https://doi.org/10.1136/bmjdrc-2020-001520

Kaplan Serin, E., & Bülbüloğlu, S. (2021). The effect of attitude to death on self-management in patients with type 2 diabetes mellitus during the COVID-19 pandemic. OMEGA-*Journal of Death and Dying*, 45(18), 389-396. https://doi.org/10.1177/00302228211020602

Kazakou, P., Lambadiari, V., Ikonomidis, I., Kountouri, A., Panagopoulos, G., Athanasopoulos, S., ... & Mitrakou, A. (2022). Diabetes and COVID-19; A Bidirectional Interplay. *Frontiers in Endocrinology*, 13 (2), 78-83. https://doi.org/10.3389/fendo.2022.780663

Liu, H., Chen, S., Liu, M., Nie, H., & Lu, H. (2020). Comorbid chronic diseases are strongly correlated with disease severity among COVID-19 patients: a systematic review and meta-analysis. Aging and disease, 11(3), 668-691. https://doi.org/10.14336/AD.2020.0502

Ludwig, S., & Zarbock, A. (2020). Coronaviruses and SARS-CoV-2: a brief overview. Anesthesia and analgesia. https://doi.org/10.1213/ANE.0000000000004845

Mantovani, A., Byrne, C. D., Zheng, M. H., & Targher, G. (2020). Diabetes as a risk factor for greater COVID-19 severity and in-hospital death: a meta-analysis of observational studies. Nutrition, Metabolism and Cardiovascular Diseases, 30(8), 1236-1248. https://doi.org/10.1016/j.numecd.2020.05.014

Önmez, A., Gamsızkan, Z., Özdemir, Ş., Kesikbaş, E., Gökosmanoğlu, F., Torun, S., & Cinemre, H. (2020). The effect of COVID-19 lockdown on glycemic control in patients with type 2 diabetes mellitus in Turkey. Diabetes & Metabolic Syndrome. *Clinical Research & Reviews*, 14(6), 1963-1966. https://doi.org/10.1016/j.dsx.2020.10.007

Oriot, P., & Hermans, M. P. (2022). Euglycemic diabetic ketoacidosis in a patient with type 1 diabetes and SARS-CoV-2 pneumonia: case-report and review of the literature. *Acta Clinica Belgica*, 77(1), 113-117. https://doi.org/10.1080/17843286.2020.1780390

Sheng, G., Chen, P., Wei, Y., Yue, H., Chu, J., Zhao, J., ... & Zhang, H. L. (2020). Viral infection increases the risk of idiopathic pulmonary fibrosis. *Journal Chest*, 157(5), 1175-1187. https://doi.org/10.1016/j.chest.2019.10.032

Smith, S. M., Boppana, A., Traupman, J. A., Unson, E., Maddock, D. A., Chao, K., ... & Connor, R. I. (2021). Impaired glucose metabolism in patients with diabetes, prediabetes, and obesity is associated with severe COVID-19. *Journal of medical virology*, 93(1), 409-415. https://doi.org/10.1002/jmv.26227

Van Baar, A. C., Holleman, F., Crenier, L., Haidry, R., Magee, C., Hopkins, D., ... & Bergman, J. J. (2020). Endoscopic duodenal mucosal resurfacing for the treatment of type 2 diabetes mellitus: one year results from the first international, open-label, prospective, multicentre study. *Gut*, 69(2), 295-303. https://doi.org/10.1136/gutjnl-2019-318349

Vickery, K. D., Novotny, P. J., Ford, B. R., Lantz, K., Kavistan, S., Singh, D., ... & Wieland, M. L. (2022). Experiences of Hispanic Safety Net Clinic Patients with Diabetes During the COVID-19 Pandemic. *The Science of Diabetes Self-Management and Care*, 48(2), 87-97. https://doi.org/10.1177/26350106221076037