



School of Public Health Independent
University, Bangladesh

**Impact of COVID-19 on people with diabetes: A Narrative
Review**
May 2022

A thesis submitted by

Shahriar Rahman (Student ID: 2022999)

in consideration of the partial fulfillment of the requirements for the degree of

Master of Public Health (MPH)

Supervised by

Dr. Md. Kamran Ul Baset, MBBS, MPH, Ph.D.

Associate Professor, Department of Public Health, School of Pharmacy and Public Health,
Independent University Bangladesh
Email: kamranspph@iub.edu.bd

Impact of COVID-19 on people with diabetes: A Narrative Review

Submitted by: **Shahriar Rahman**
Student ID: 2022999

Independent University, Bangladesh

Supervised by:

Dr. Md. Kamran UI Baset, MBBS, MPH, Ph.D.
Associate Professor, Department of Public Health,

School of Pharmacy and Public Health, Independent University, Bangladesh

Email: kamranspph@iub.edu.bd

Course Name: Thesis
Course ID: HSC575

School of Public Health, Independent University, Bangladesh

Declaration

I, Shahriar Rahman, declare that this narrative review is my own unaided work and all the sources to the best of my knowledge.

Shahriar Rahman (ID 2022999)

Dedication

To my dear parents Md. Fazlur Rahman and Mrs. Safiunnaher

Acknowledgement

First of all thanks to Almighty Allah; for granting me this opportunity to conduct this thesis as well as allowing me to fulfil my dream of acquiring this MPH degree.

Secondly, I am extremely grateful to my thesis supervisor, Dr. Kamran Ul Baset, for all his support and suggestions whenever I needed it. Thanking is not enough to value the effort and guidance which I have received.

I am also very thankful to each of my faculty members of Department of Public Health, School of Pharmacy and Public Health, IUB. Gratitude also goes to my fellow batchmates for all the support.

INTRODUCTION

The pandemic of coronavirus disease 2019 (COVID-19) has now infected over 14 million people worldwide. People with diabetes have been identified as being at increased risk of serious illness from COVID-19. Understanding these risks is one of the best ways to mitigate them. Previous studies have also shown that diabetes is a risk factor for severe cases of viral infections, including SARS, Middle East respiratory syndrome (MERS), and novel influenza A (H1N1). [1]

The evidence on the impact of COVID-19 on people with diabetes is minimal, but it is growing. People with diabetes appear to have a higher chance of COVID-19 infection, while the evidence to quantify this risk is still inadequate. Evidences are emerging that relate higher BMI and higher HbA1c to worse outcomes in patients with COVID-19, but the extent to which clinical and demographic factors modify this relationship is unknown. COVID-19 not only poses a direct risk to people with diabetes, but it also has the potential to worsen diabetes outcomes as a result of pandemic-related disruptions, such as stress and changes in routine care, diet, and physical activity. [1]

From two U.K. based studies, we get to know that diabetes was independently associated with a higher risk of death that increased with higher HbA1c. Compared with people without diabetes, one study reported that people with diabetes with HbA1c >7.5% (58 mmol/mol) had a higher chance of in-hospital death than those with HbA1c <7.5% [2]. Diet and physical activity are integral parts of diabetes self-management. But a US based survey found out that 1/3 rd of the respondents were having less healthy diet and less exercise [2].

Patients with diabetes may be prone to more severe SARS-CoV-2 infection due to dysfunction in immune system dysfunction. Viral infections may worsen hyperglycemia in people with diabetes, which may adversely influence prognosis. Use of some anti-hyperglycemic drugs are also limited due to potential harmful effect to COVID-19 patient (eg.hypoxia) [1].

COVID-19 has seriously impacted the diagnosis of diabetes mellitus, specially type-2. Early detection of type 2 diabetes and treatment are very much important. But due to the pandemic, screening of diabetes was affected which ultimately resulted in future diabetes-related complications [3]. Some studies have considered the rapidity of worsening glycemic control in stable diabetic patients with COVID-19 requiring the use of high insulin dose and suggested the possibility of pancreatic invasion by the SARSCoV-2. This perspective has been supported by the finding of high levels of ACE2 in the pancreatic islet beta cells which may cause increased islet cell injury and impaired insulin secretion [4].

Some studies suggest that patients with diabetes who have poorly controlled glycemia are in risk of four times higher death rate and longer length of hospital stay compared to patients without DM. However, the specific molecular interactions between DM and COVID-19 are not understood well at this moment. [6].

The COVID-19 pandemic has caused an increase in anxiety and distress in the general public. People with diabetes face trouble accessing the resources they need because of the pandemic situation, which increases their anxiety and distress. They should be encouraged to employ simple behavioral strategies to combat feelings of distress and anxiety which can help them a great deal [7].

Thesis Organization

This thesis is organized in seven chapters. The next chapter of the thesis includes the research question addressed in this study along with the study objectives. Later, the detailed methodology has been added. The next chapter contains the major findings from this study. It is followed by a summary and critical appraisal of the chosen articles. At the end, the study discusses the major topics derived from the study findings and ends with conclusive remarks.

RESEARCH QUESTION & OBJECTIVES OF THE STUDY

Research Question of the Study

This study is designed to answer one major research question which is, “How COVID-19 has impacted the people with diabetes? ”

General Objective of the Study

The general objective of this study is to identify the impact of COVID-19 on people with diabetes.

Specific Objectives of the Study

Specifically this study will try to summarize the risks and severity that can be caused by COVID-19 to diabetic patients as well as look into the ways of managing diabetes during the COVID-19 pandemic.

Methods

The study was conducted following standard systematic review methodology as per 27-itemized PRISMA checklist. The author, himself, was responsible to conduct various stages of this review under the guidance of the supervisor. The overall process of the study included multiple stages which have been discussed in the following sub-sections of the paper.

Search Strategy Formulation

Multiple keywords were listed for literature searching. Some of the most used keywords included impact of COVID-19 on people with diabetes, effect of COVID-19 on on people with diabetes, HbA1C control, outcome of diabetic patients, glycaemic control in lockdown, weight gain in lockdown, medication in lockdown, older people with diabetes and COVID-19 and so on. Hand searching was also performed using Google Scholar, PubMed, Hindawi, Wiley library, BMJ journals and BMC.

Literature Searching and Paper Selection

Peer-reviewed journal articles were searched in the above-mentioned electronic databases using different combinations of the keywords mentioned earlier. Based on an initial screening of the study titles, suitable articles were extracted. Also, the reference lists of the primarily selected

articles were searched to find out more suitable journal articles that have relevant study titles. To assure a better organization of the articles, each paper was assigned a unique paper ID for future ease. Then, titles, the abstracts of the articles were reviewed. At this stage, depending on the exclusion and inclusion criteria, suitable articles were chosen.

Selection Criteria for Paper Selection

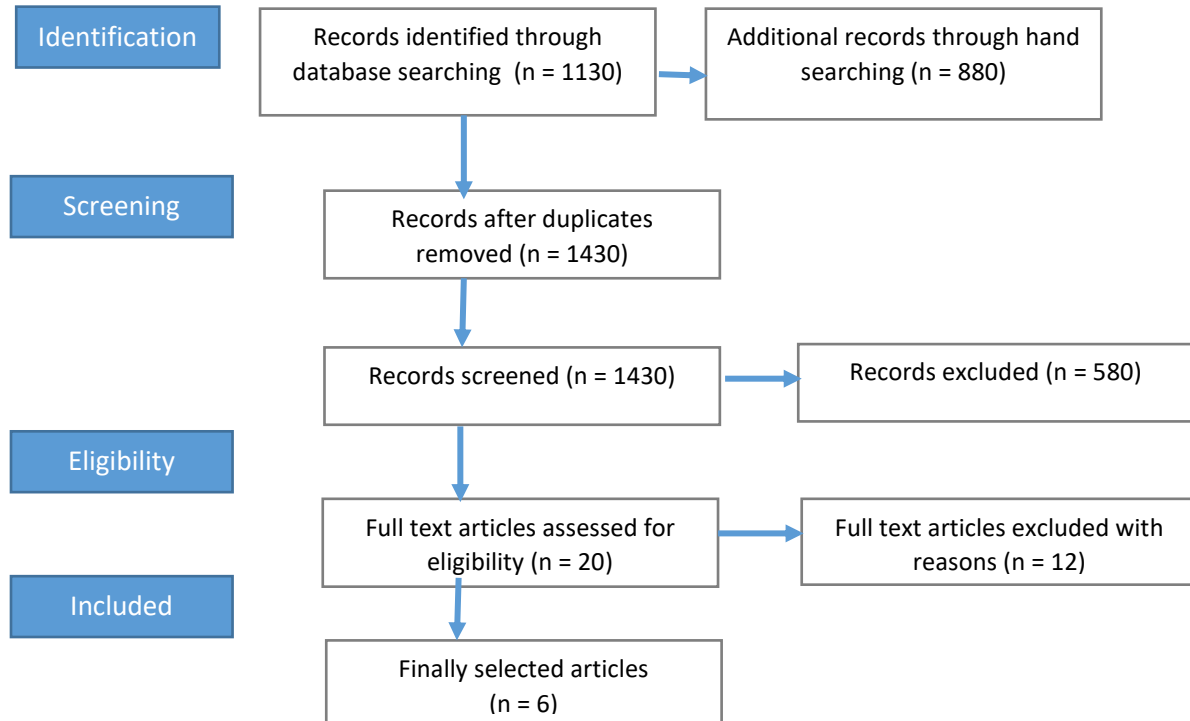
Topic	Inclusion Criteria	Exclusion Criteria
Targeted Population	Adult population with type-1 or type-2 diabetes	Studies with children with diabetes
Outcomes	Studies that measured different health outcomes of diabetic population affected by COVID-19	Studies that measured the impact of disease other than COVID-19
Time Interval	Studies published on or after January 2020	Studies published before January 2020
Study Language	English	Any language except English

Results

Findings from Literature Searching

Six articles were finally selected from literature searching which followed a series of steps; including the initial retrieval of 1130 articles from the bibliographic database searching and the retrieval of additional 880 articles from hand searching of databases (PubMed and Google Scholar). By removing duplicates, 1430 unique articles were found. Title and abstract screening resulted in the retrieval of 20 articles which were screened once again following the study's

exclusion and inclusion criteria. These series of steps concluded to the final identification of six articles which were relevant and suitable as per the study's exclusion and inclusion criteria. The six selected articles (Jasbir Makker et al., 2021; Luca D'Onofrio MD et al., 2021; Matthew J Carr et al., 2021; Claudia Eberle et al., 2021; Yasuhiro Tanji et al., 2021; Merel M Ruissen et al.,



2021;) were later used for data extraction and data analysis. To illustrate the numeral findings from the study's literature searching and study selection process, the following figure has been prepared as per the standardized PRISMA flow diagram.

The following table includes some additional information (i. e. article title, authors, year of publication, journal name etc.) to better understand different features of the selected articles.

Paper ID	Study Title	Authors	Year of Publication	Search Engine	Journal Name, volume (issue)
ID 1	Impact of Prediabetes and Type-2 Diabetes on Outcomes in Patients with COVID-19	Jasbir Makker ,Haozhe Sun ,Harish Patel ,Nikhitha Mantri ,Maleeha Zahid ,Sudharsan Gongati ,Sneha Galiveeti ,Sharon W. Renner and Sridhar Chilimuri	2021	Hindawi	<i>International Journal of Endocrinology</i> <i>Volume 2021</i>
ID 2	Effects of the COVID-19 lockdown on glycaemic control in subjects with type 2 diabetes: the glycalock study	D'Onofrio L, Perialice S, Maddaloni E, et al.	2021	Wiley Online Library	<i>Diabetes Obes Metab. 2021;23:1624–1630</i>
ID 3	Impact of COVID-19 restrictions on diabetes health checks and prescribing for people with type 2 diabetes: a UK-wide cohort study involving 618 161 people in primary care	Carr MJ, Wright AK, Leelarathna L, et al	2021	BMJ	<i>BMJ Qual Saf 2021;0:1–12.</i>
ID 4	Impact of COVID-19 lockdown on glycemic control in patients with type 1 and type 2 diabetes mellitus: a systematic review	Claudia Eberle and Stefanie Stichling	2021	BMC	<i>Eberle and Stichling Diabetol Metab Syndr (2021) 13:95</i>
ID 5	Impact of COVID-19 pandemic on glycemic control among outpatients with type 2 diabetes in Japan: A hospital-based survey from a country without lockdown	Yasuhiro Tanji, Shojiro Sawada, Taichi Watanabe, Takashi Mita, Yasutaka Kobayashi, Takahisa Murakami, Hirohito Metoki, Hiroaki Akai	2021	PubMed	<i>Diabetes Research and Clinical Practice 2021 (176)</i>
ID 6	Increased stress, weight gain and less exercise in relation to	Ruissen MM, Regeer H, Landstra CP, et al.	2021	PubMed	<i>BMJ Open Diab Res Care 2021;9</i>

	glycemic control in people with type 1 and type 2 diabetes during the COVID-19 pandemic.				
--	--	--	--	--	--

ARTICLE SUMMARY & CRITICAL APPRAISAL

The six selected articles have been summarized in the following subsections:

Paper ID 1

Context: As the COVID-19 pandemic evolves and claims more lives, the true impact of type-2 diabetes in patients infected with COVID-19 is not yet clearly understood. Also the pathophysiology underlying the poor outcomes in type-2 diabetes patients with COVID-19 is not fully understood as well. Studies published so far have provided conflicting evidence.

Furthermore, very little is known or studied about outcomes of COVID-19 in patients with prediabetes, who have similar metabolic condition, though not to the same extent as in type-2 diabetes. This study was conducted with two aims in mind: (1) To study the effect of type-2 diabetes on outcomes in COVID-19 patients in the study population which predominantly comprises Latin and African American patients and (2) To explore the impact of prediabetes on outcomes in COVID-19 patients.

Methodology: This was a single-center retrospective observational study involving 843 hospitalized patients with SARS-CoV-2 infection. Primary outcomes, mortality, and mechanical ventilation use were compared among the three groups: control, prediabetes, and type-2 diabetes. Binomial regression analysis was used to determine predictors of mortality and mechanical ventilation requirement.

Findings: This study showed that, age was a significant predictor of mortality. Older patients aged 55 years and above had no difference in mortality or mechanical ventilation requirement among the three groups of control, prediabetes, and type-2 diabetes. However, among the younger population (age less than 55 years), patients with type-2 diabetes had significantly higher mortality as compared with other groups (27% vs 12.5%-control vs 9%-prediabetes). Newly diagnosed type-2 diabetes patients showed lower mortality rate than known type-2 diabetes patients (18% vs 40%, p 0.005). Outcomes in the prediabetes group were similar to that in the control group. Admission hyperglycemia was associated with higher mortality regardless of diabetes status. Overall it was found that, in older patients aged 55 years and above, status of type-2 diabetes does not influence their mortality but in younger patients aged less than 55 years, the presence of type-2 diabetes is an important driver of mortality.

Critical Appraisal: Results of this study show that age remains the biggest risk factor for mortality in patients hospitalized with COVID-19 infection. Right from beginning of the COVID-19, advanced age was found as a predictor of severe COVID-19 infection and mortality and this study results are consistent with this previously reported data demonstrating higher mortality among older age group. This study brings out another important but previously reported finding that admission hyperglycemia is an independent risk factor for worse outcomes and mortality. Among the limitations of this study, firstly it is a retrospective study which has its inherent problems due to the retrospective design. Secondly, the study population mostly comprised of Latinx and African Americans and hence the findings cannot be generalized. Thirdly, HbA1c lab values used to categorize patients were not within 3 months for all the patients.

Paper ID 2

Context: The outbreak of coronavirus disease 2019 (COVID-19) has forced our society to face both the direct and indirect effects of the pandemic. The most important direct effect was seen in healthcare system, specially in emergency management. The indirect effects of the pandemic are mainly caused by the lockdown and social distancing. An assessment of these effects on insulin-treated diabetes is very much time demanding. The primary aim of this study was to assess the effect of lockdown on glycaemic control in patients with T2D in a multicentre study enrolling matched controls. The secondary aim was to explore whether psychological health, employment status, education, type of antidiabetes treatment and self-reported adherence to physical activity and dietary recommendations had an impact on diabetes management during lockdown.

Methodology: This was an observational, multicentre, retrospective study conducted in the Lazio region, Italy, which compared the differences in the HbA1c levels of 141 subjects with T2D exposed to lockdown with 123 matched controls with T2D who attended the study centres 1 year before. Basal data were collected from 9 December to 9 March and follow-up data from 3 June to 10 July in 2020 for the lockdown group, and during the same timeframes in 2019 for the control groups. Changes in HbA1c and body mass index during lockdown were compared among patients with different psychological wellbeing, as evaluated by tertiles of the Psychological General Well-Being Index.

Findings: The study found no difference in HbA1c between the lockdown and control groups (lockdown group -0.1% [-0.5% – -0.3%] vs. control group -0.1% [-0.4% – -0.2%]; $p = .482$). Also, no difference was found in BMI ($p = .316$) or Glucose ($p = .538$). In the lockdown group, subjects with worse PGWBS showed a worsening of HbA1c ($p = .041$ for the trend among

PGWBS tertiles) and BMI ($p = .022$). Subjects in the lowest tertile of the PGWBS score, namely, those with the poorest psychological well-being, showed a worsening in their metabolic control-HbA1c and BMI. Only retired patients showed an improvement in HbA1c during the lockdown while no differences were observed among workers.

Critical Appraisal: Most of the studies published during 2020 were focused on the acute effects of COVID-19; few studies explored the indirect effect of the pandemic on specific populations, especially in subjects with T2D. This is one of the first studies investigating the effect of lockdown on glycaemic control in patients affected by T2D. No significant difference in HbA1c was found comparing subjects with stable therapy exposed to lockdown measures compared with controls. These observations are consistent with previous findings in patients with insulin-treated diabetes. These results can be useful in clinical work planning, suggesting that patients with good prelockdown glycaemic control not requiring changes in antidiabetes therapy are able to cope with T2D, regardless of their education level and multiple daily doses of insulin treatment. The limitations of this study include the retrospective study design and self-reported data about adherence to prescribed diet and physical activity. The exclusion of patients who required intensification of antidiabetes therapy might have caused selection bias. Among the strength was multicentre design which reduced the bias of the single-centre study, and the availability of various data about key factors possibly influencing glycaemic control during lockdown. Further, another major strength was that data collected were compared with data from age- and gender matched subjects enrolled during the same timeframe 1 year before, in order to obtain a control group that was not experiencing the effects of lockdown measures.

Paper ID 3

Context: In 2008, the National Institute for Health and Care Excellence (NICE), serving the National Health Service (NHS) in England and Wales, recommended nine essential ‘health checks’ or so-called ‘care processes’ that define high-quality diabetes care. NICE recommended that people with diabetes should have at least annual checks of weight, blood pressure, smoking status, haemoglobin A1c (HbA1c), cholesterol, creatinine, urinary albumin, retinopathy and feet. However, there are limited data on the impact of the COVID-19 pandemic on diabetes health checks and prescribing in primary care. So this study was designed to compare rates of performing National Institute for Health and Care Excellence-recommended health checks and prescribing in people with type 2 diabetes (T2D), before and after the first COVID-19 peak in March 2020, and to assess whether trends varied by age, sex, ethnicity and deprivation.

Methodology: 618161 people with T2D were studied between March and December 2020 from 1744 UK general practices registered with the Clinical Practice Research Datalink. Focus was given on six health checks: haemoglobin A1c, serum creatinine, cholesterol, urinary albumin excretion, blood pressure and body mass index assessment. Regression models compared observed rates in April 2020 and between March and December 2020 with trend-adjusted expected rates derived from 10-year historical data.

Findings: The study showed that, in April 2020 rates of performing health checks were reduced by 76%–88% when compared with 10-year historical trends, with older people from deprived areas experiencing the greatest reductions. Between May and December 2020, the reduced rates recovered gradually but overall remained 28%–47% lower, with similar findings in other UK nations. Rates for new medication fell during April with reductions varying from 10% (95% CI: 4% to 16%) for antiplatelet agents to 60% (95% CI: 58% to 62%) for antidiabetic medications.

Overall, between March and December 2020, the rate of prescribing new diabetes medications fell by 19% (95% CI: 15% to 22%) and new antihypertensive medication prescribing fell by 22% (95% CI: 18% to 26%), but prescribing of new lipid-lowering or antiplatelet therapy was unchanged. Extrapolated to the UK population, between March and December 2020, there were ~31 800 fewer people with T2D prescribed a new type of diabetes medication and ~14 600 fewer prescribed a new type of antihypertensive medication.

Critical Appraisal: This study showed marked reductions in the rate of health checks and new prescribing in people with T2D as indirect consequences of the COVID-19 pandemic. In coming days healthcare services will need to manage this backlog of testing and prescribing, and the anticipated greater deterioration of HbA1c and other CVD risk factors such as blood pressure levels. Older people from deprived backgrounds with T2D may be specific groups to target for early health checks and intervention. Among the strength of this study, this was the first UK-wide study reporting the indirect impact of the COVID-19 pandemic on health checks and prescribing in people with T2D. Some of the limitations were, not reporting data on retinopathy, smoking and foot checks, not presenting data on type 1 diabetes, ethnicity coding not adequately captured in primary care, not assessing risk factor levels and assessments of weight and blood pressure and no data collection on assessments of weight and blood pressure assessed by patients in their homes.

Paper ID 4

Context: Coronavirus disease 2019 (COVID-19) was classified as a pandemic in a short period of time. In order to reduce the spread of COVID-19, many countries have imposed a lockdown with movement restrictions, social distancing and home confinement, which has affected routine healthcare activities and everyday life. The aim of this systematic review was to examine the impact of the COVID-19 lockdown on glycemic control in patients with type 1 diabetes (T1D) and type 2 diabetes (T2D).

Methodology: For this systemic review, studies were systematically identified by searching the databases Cochrane Library, MEDLINE via PubMed, Web of Science Core Collection, EMBASE, and CINAHL until April 2021. A total of 33 observational studies were included of which 25 investigated T1D and 8 investigated on T2D. Peer-reviewed studies published in English and German were considered. Also in the consideration was observational studies (eg. cohort studies, cross-sectional studies, case–control), retrospective and prospective, that examined the effect of COVID-19-lockdown (infection control measures and their consequences; restrictions, social distancing, quarantine) on glycemic parameters on type 1 and type 2 diabetes patients.

Findings: Overall 2881 T1D patients and 1823 T2D patients were analyzed in this systemic review. The study showed that, glycemic values in patients with T1D improved significantly during lockdown. Overall 72% T1D studies indicated significant improvements in glycemic outcomes. Meta-analysis revealed a mean difference in HbA1c of -0.05% (95% CI -0.31 to 0.21) due to lockdown, and in time in range (TIR) of $+3.75\%$ (95% CI 2.56 to 4.92). However, lockdown showed a short-term worsening in glycemic values in patients with T2D. Overall 50%

publications observed deteriorations in glycemic control. The meta-analysis demonstrated a mean difference in HbA1c of + 0.14 (95% CI – 0.13 to 0.40) through the lockdown. Moreover 75% studies reported a not significant deterioration in body weight. In two T2D studies, the patients received telemedicine care, but telemedicine was not described in detail.

Critical Appraisal: This study showed that in general, glycemic parameters in patients with T1D significantly improved during COVID-19 lockdown and in contrast lockdown determined a short-term worsening in glycemic values in patients with T2D. The study showed that the effect of pandemic lockdown on T1D and T2D were very different. T1D and T2D have a contrasting pathogenesis, which also results in appropriate therapy recommendations with different priorities. The strength of this study is, this review presents the first overview of the impact of the COVID-19 lockdown on glycemic values of T1D and T2D patients. The study has few limitations like considering only English and German literature and taking only few studies with regard to T2D patients. The lockdown regulations also varies from country to country, this should be kept in mind while considering the analysis of this review.

Paper ID 5

Context: Various studies have reported changes in glycemic control of patients with diabetes mellitus under lockdown. However, no previous study examined the impact of the pandemic on glycemic control in patients with diabetes in countries that did not introduce a lockdown. One such country is Japan. This study aimed to assess changes in glycemic control during the pandemic in patients with type 2 diabetes treated at a Japanese clinic.

Methodology: This study was conducted as a historical cohort study, using electronic medical records of patients with type 2 diabetes who visited Japanese clinics between January 2019 and

August 2020. Differences in HbA1c values before and after the outbreak of COVID-19 were the primary outcome, which was examined using the linear mixed model. Patients with type 1 or another type of diabetes, including pancreatic, hepatic, or gestational diabetes, and secondary diabetes from endocrine disease were excluded from the study. Only patients with type 2 diabetes were included.

Findings: A total of 1,631 patients with type 2 diabetes were included after initial screening. The study showed that, HbA1c values significantly increased from 7.45% to 7.53% after the state of emergency was introduced (n = 1,009). Furthermore, a deterioration in HbA1c values was observed in particular among women, patients aged more than 65 years, those with body mass index of more than 25 kg/m², and those that were not using insulin.

Critical Appraisal: The study findings suggest that HbA1c values significantly worsened after the state of emergency was declared while the BMI remained stable in the study population. Even without lockdown, stress levels, overall dietary intake, snack consumption, and prepared food intake increased, while time dedicated to sleep and exercise decreased after the state of emergency was declared. These behavioral changes contributed to increases in HbA1c and BMI values. The strength of the study was that, this is the first study to report changes in HbA1c values during the COVID-19 pandemic in patients with type 2 diabetes in a country that did not impose a lockdown. Among the limitations of the study is that, this was a single center retrospective study. Furthermore only HbA1c values were used to assess glycemic control and several important clinical parameters affecting glycemic control were not assessed in this study.

Paper ID 6

Context: Lockdown measures can have effect on many aspects of daily life relevant for diabetes self-management. This study assessed whether lockdown measures, in the context of the COVID-19 pandemic, differentially affect perceived stress, body weight, exercise and related this to glycemic control in people with type 1 and type 2 diabetes.

Methodology: This was a short-term observational cohort study at the Leiden University Medical Center. People with type 1 and type 2 diabetes ≥ 18 years were eligible to participate. Participants filled out online questionnaires, sent in blood for hemoglobin A1c (HbA1c) analysis and shared data of their glucose sensors. HbA1c during the lockdown was compared with the last known HbA1c before the lockdown.

Findings: 435 people were included in this study where an increase in perceived stress and anxiety, weight gain and less exercise was observed in both groups. There was improvement in glycemic control in the group with the highest HbA1c tertile. Perceived stress was associated with difficulty with glycemic control. BMI, presence of cardiovascular disease, systolic blood pressure or use of blood pressure-lowering agents was not associated with a change in stress or HbA1c during the lockdown period.

Critical Appraisal: This short-term observational study shows that lockdown measures resulted in increased levels of perceived stress, weight gain and less exercise in both people with relatively well-controlled type 1 and type 2 diabetes, however this did not negatively impact glycemic control. Additional risk factors for adverse outcomes of COVID-19, including poor glycemic control, do not appear to influence this effect. The study's strength includes strengths large study population, consisting of both people with type 1 and type 2 diabetes. A limitation of

the study is the reliance on self-reported data due to restricted access to health facilities during the lockdown period.

Limitations of the study

The study focuses on Impact of COVID-19 on people with diabetes. However, while conducting the study, several limitations have come to authors attention. Firstly, limited number of search engines were used for the articles selection. The finally selected article number was also low. More articles selected from wide range of search engines would have enriched the findings of the study. Another limitation is, maximum studies are focused on type-2 diabetes, so data is lacking on type-1 and other type of diabetes. These are the major limitations of this study which should be taken care of during future research.

Conclusion & Recommendations

The narrative review focused on the impact of COVID-19 on people with diabetes. Studies showed various types of impact on diabetic population. It was found that age was a significant predictor of mortality for diabetic patients. One study surprisingly showed, younger population (age less than 55 years), patients with type-2 diabetes had significantly higher mortality. Newly diagnosed type-2 diabetes patients showed lower mortality rate than known type-2 diabetes patients during this pandemic. Psychological situation of diabetic population was also an important factor for disease outcome. People with poor psychological well-being, showed a worsening in their metabolic control-HbA1c and BMI. Access to healthcare was affected, one study showed health checks were reduced by 76%–88% when compared with 10-year historical

trends. Lockdown situation showed a short-term worsening in glycemic values in patients with T2D glycemic values in patients with T1D improved significantly during lockdown T1D and T2D have a contrasting pathogenesis, which also results in appropriate therapy recommendations with different priorities. HbA1c values significantly increased from 7.45% to 7.53% after the state of emergency was introduced. Furthermore, a deterioration in HbA1c values was observed in particular among women, patients aged more than 65 years. The following recommendations can be suggested based on the outcomes of the study:

1. Multicenter, prospective studies should be conducted with a study population consisting of multiple ethnicity so that the results can be considered as generalized.
2. Both type-1 and type-2 diabetes should be taken into consideration since they have a contrasting pathogenesis, which also results in appropriate therapy recommendations with different priorities.
3. While reporting data on the impact of COVID-19 on diabetic patients, data should be reported on retinopathy, nephropathy, foot infection and other diabetic complications.

References

1. Jamie Hartmann-Boyce, Elizabeth Morris, Clare Goyder, Jade Kinton, James Perring, David Nunan, Kamal Mahtani, John B. Buse, Stefano Del Prato, Linong Ji, Ronan Roussel, and Kamlesh Khunti, Diabetes and COVID-19: Risks, Management, and Learnings From Other National Disasters, *Diabetes Care* 2020;43:1695–1703
2. Xu Z, Wang Z, Wang S, et al. The impact of type 2 diabetes and its management on the prognosis of patients with severe COVID-19. *Journal of Diabetes*. 2020;12: 909–918

3. Carr MJ, Wright AK, Leelarathna L, et al. Impact of COVID-19 on diagnoses, monitoring, and mortality in people with type 2 diabetes in the UK. *Lancet Diabetes Endocrinol.* 2021;9(7):413-415. doi:10.1016/S2213-8587(21)00116-9
4. Ugwueze C, V, Ezeokpo B, C, Nnolim B, I, Agim E, A, Anikpo N, C, Onyekachi K, E: COVID-19 and Diabetes Mellitus: The Link and Clinical Implications. *Dubai Diabetes Endocrinol J* 2020;26:69-77.
5. Farooqi M, H: Tele-Management of Diabetes in the Post-COVID-19 Era. *Dubai Diabetes Endocrinol J* 2020;26:47-49.
6. Habib Yaribeygi, Thozhukat Sathyapalan, Tannaz Jamialahmadi, Amirhossein Sahebkar, "The Impact of Diabetes Mellitus in COVID-19: A Mechanistic Review of Molecular Interactions", *Journal of Diabetes Research*, vol. 2020
7. Zhang JY, Shang T, Ahn D, Chen K, Coté G, Espinoza J, Mendez CE, Spanakis EK, Thompson B, Wallia A, Wisk LE, Kerr D, Klonoff DC. How to Best Protect People With Diabetes From the Impact of SARS-CoV-2: Report of the International COVID-19 and Diabetes Summit. *J Diabetes Sci Technol.* 2021 Mar;15(2):478-514

Paper ID 1: Jasbir Makker et al, Impact of Prediabetes and Type-2 Diabetes on Outcomes in Patients with COVID-19, *International Journal of Endocrinology* Volume 2021, Article ID 5516192

Paper ID 2: D'Onofrio L, Peralice S, Maddaloni E, et al. Effects of the COVID-19 lockdown on glycaemic control in subjects with type 2 diabetes: the glycalock study. *Diabetes Obes Metab.* 2021;23:1624–1630

Paper ID 3: Carr MJ, Wright AK, Leelarathna L, et al. *BMJ Qual Saf Epub*; doi:10.1136/bmjqs-2021-013613

Paper ID 4: Claudia Eberle and Stefanie Stichling, Impact of COVID-19 lockdown on glycemic control in patients with type 1 and type 2 diabetes mellitus: a systematic review, Eberle and Stichling Diabetol Metab Syndr (2021) 13:95

Paper ID 5: Yasuhiro Tanji et al, Impact of COVID-19 pandemic on glycemic control among outpatients with type 2 diabetes in Japan: A hospital-based survey from a country without lockdown, diabetes research and clinical practice 176 (2021)

Paper ID 6: Ruissen MM, Regeer H, Landstra CP, et al. Increased stress, weight gain and less exercise in relation to glycemic control in people with type 1 and type 2 diabetes during the COVID-19 pandemic. BMJ Open Diab Res Care 2021;9: