



Comorbidities: A Decider of Severe Clinical Outcomes in COVID-19 Patients

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

Background: Comorbidity is the biggest decider in COVID-19 pandemic whether the infected person will develop the severe clinical outcome or not. It is one of the few conclusions that has widespread acceptance.

Summary: After analyzing the case fatalities of COVID-19, many patients were found to be having either one of many conditions which are commonly called as comorbidities due to which they cannot make it to survivors list. Also several COVID-19 patients requiring the sophisticated medical attention like ventilators and oxygen support system have any kind of underlying medical condition. Deteriorated immune system is one of the reasons behind slipping into severe symptoms category.

Conclusion: It is established that comorbidities are the major influencer in COVID-19 infected patients. More study is needed to further segregate the data on the basis of each comorbidity.

Keywords: COVID-19; diabetes; CVD, COPD; comorbidity; obesity; hypertension; renal ailments.

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1. INTRODUCTION

Coronavirus disease 2019 or COVID-19 has inflicted an unprecedented amount of damage on the human and surrounding ecosystem as a whole. The highly contagious nature of the novel coronavirus which was first discovered in Wuhan City of Hubei province of China and capacity of producing lethal clinical outcomes makes it one of the feared disease outbreak in centuries. As of February 12, 2021, 107,802,327 infection cases of COVID-19 have been registered across more than 200 regions of the world inhabited by humans and 2,368,807 case fatalities have been reported [1]. Both the parameters had crossed the unfortunate mark of hundred million and two million respectively and still the pandemic is ongoing and continuously evolving creating more challenges. In early days of the pandemic itself, World Health Organization (WHO) was compelled to upgrade the status of disease epidemic to pandemic after analyzing the nuisance value to alert the world [2]. This was first such declaration of WHO since its inception. United States of America, India, Brazil, Russian Federation, United Kingdom and France are the top position holders in the world in terms of case infections of COVID-19 and case fatalities associates with the complications created by the said disease [3]. The new mutated strain of the novel coronavirus reported from South Africa, Brazil and United Kingdom is a serious cause of concern considering its higher virulent nature than the present strain [4]. The pandemic after its one year, is still evolving and many studies are ongoing to observe the behavioral pattern of the novel coronavirus. Several studies have been and some concrete conclusions can now be established without any hesitations. Comorbid patients or patients with underlying chronic medical conditions are vulnerable to catching the COVID-19 as well as more prone to developing severe clinical symptoms; post infection is one of them [5]. Various comorbidities like diabetes mellitus, obesity, cardiovascular diseases, renal ailments, chronic obstructive pulmonary disease (COPD) and many more diseases are on the list. These diseases combined with COVID-19 infection produce unwanted and lethal clinical. Therefore it is important to study the disease thoroughly and arrive at conclusion. Various long term implications are also attached to aforementioned scenario and it is therefore advisable to prevent the COVID-19 from happening at first place rather going into curative situation. This article tried to comprehensively

overview all the above mentioned topics and arrive at meaningful conclusion.

2. COMORBIDITIES AND COVID-19

Coronavirus disease 2019 or COVID-19 is major disease pandemic that has happened in the history of modern human civilization [6]. The adverse impact which has been put on the humans is immense and must be dealt with utmost priority. Containment is the primary and immediate short term goal which should be achieved as soon as possible. As the disease pandemic is new in nature and does not provide any past behavioral records, it is surely a difficult task to control the pandemic. Constant study of the continuously emanating patients outcomes and through research along with due deliberations on the mitigation strategy would act as the medicine. Various conclusions have been established and one of the major path breaking conclusion about underlying medical conditions in COVID-19 scenario is worth exploring. It is now confirmed that underlying medical conditions are the decider of the clinical outcomes. Whether it will be severe or mild. Under lying medical conditions of chronic nature also known as comorbidities are of various types such as diabetes mellitus, cardiovascular ailments, obesity, renal ailments, liver cirrhosis, lung related infections, chronic obstructive pulmonary disease (COPD) and so on can be bad thing to have during COVID-19 infection. The mechanism of the novel coronavirus or SARS-COV-2 is that it gets attached to the angiotensin-converting enzyme 2 (ACE 2) receptors which are paced on various organs of the body to gain control of the host cell of the weakened immune system. This is the useful condition for the novel coronavirus to thrive [7]. The above mentioned comorbidities provides the same condition of weakened immune system. In addition the chances of inter mingling of medicines of existing condition and of COVID-19 is high and therefore medical complications can arise. Age is no bar for the comorbidities to worsen the COVID-19 infected patient's condition. All age groups having comorbidities are vulnerable to develop the severe clinical outcomes. Severe clinical outcomes generally mean admission to the hospitals, intensive care unit, need of sophisticated medical equipment and mortalities due to COVID-19. Comorbidities are non-contagious and contributes to almost 66 percent of mortalities worldwide each year. The number stands at 36 million deaths per year which is huge and comorbidity in itself is a big problem to

deal with. Comorbidities or underlying medical condition not only proves bad after infection of COVID-19, it increases the chances of the contraction of COVID-19 infection. Comorbidities can be due to range of factors such as sedentary lifestyle, unhealthy eating pattern, lack of adequate physical exercise, high intake of high sugar and fats foods, lack of sun exposure, pollution and surrounding conditions like air pollution, sound pollution etc. Comorbidities can last up to decades and sometimes it is not cured in person's lifetime. Comorbid person must constantly be under medical scanner so that medicine or surgery can be prescribe to it according to the condition. Some comorbidities can prove to be worse in COVID-19 infection than other creating need of through and further research on this aspect [8].

3. DIABETES MELLITUS AND COVID-19

Diabetes mellitus is the metabolic disease in which the blood sugar levels of the affected person remains at high levels. The insulin, hormone which controls the blood sugar levels is either not produced enough by the body or the utilization of the insulin does not take place properly during diabetic condition. High blood sugar, if left untreated, can cause damage to various parts of the body. There are broadly two types of Diabetes which are type 1 and type 2. One of the worst comorbidity of underlying medical condition to have in COVID-19 infection is diabetes mellitus. There are several reasons behind this postulate and they are established by various studies. Because diabetes mellitus does not happen alone and bring about other medical conditions such as hypertension, renal failure and other medical conditions which are complicated to cure [9]. Various study have been successful in establishing that diabetic patients takes longer time and more sophisticated medical attention than the non-diabetic patients during the infection of COVID-19. Diabetic retinopathy can increase the chance of person demanding a ventilator or oxygen support by almost five times. Persons with diabetes mellitus do not only suffer from imbalanced insulin level, they also suffers from the accumulation of glucose in blood which leads to thickening of the plasma. It reduces the fluidity and makes it hard to reach every corner of the body with all the essential nutrients and oxygen, which is also a cause of delayed healing in the diabetic patients if they get even small sore. In general, people with diabetic condition already were taking longer time in heling or responding to treatment and COVID-19 only added to the woes. The immunity

of a diabetic person is already low which is a vulnerable situation to have in pandemics like COVID-19 which are extremely contagious and fatal. The medications that control the insulin level may provide some relief but even small event of infection can hinder with the blood glucose levels resulting in the imbalance of the system. It is established that sugar levels pose a greater threat in the clinical management of the coronavirus disease 2019 [10]. Diabetes mellitus is an immunosuppressive medical condition which is chronic in nature and persist for very long duration resulting in overall damage to the innate immune response. Diabetic patients also have other underlying medical condition such as hypertension, cardiovascular ailments, respiratory decline, obesity which are all works in the favor of COVID-19 to further worsen the condition. Due to lung condition brought about by diabetes, person may be vulnerable to COVID-19 pneumonia which is a severe clinical symptoms and requires sophisticated care and clinical outcomes are mostly against the patient affected. The capacity of the human body to defeat the external pathogenic invasion naturally and innately has been adversely affected by the diabetes. The inflammation triggered by the COVID-19 is supplemented by already inflamed situation in the body that had caused by diabetes mellitus. A study in Wuhan suggested some empirical evidences about diabetes mellitus. 881 samples of blood glucose levels measured among which 56 percent of the samples were identified as abnormal. All the patients were infected by COVID-19. 70 percent of the said patients were compelled to intensify the insulin therapy during the COVID-19 infection. All these patients were suffering from type 2 diabetes mellitus. The special attention to all types of diabetic patients must be given as the mortalities and risk of slipping into severe symptoms is high among those. Regular monitoring of blood glucose levels are advised with type 1 diabetes mellitus patients are most prioritized. Also many clinics are almost closed excepting few which only are open for emergencies. Diabetic patient's needs constant medical interventions and hospitals must be cautious about this fact. Insulin therapy is a non-stop, constantly going therapy which needs regular rectifications. This must be provided so that non-COVID-19 diabetic patients must be taken care off. Pathological reports of blood culture can be uploaded to doctor's site which can be then analyzed and prescription can be given through telemedicine if shortfall of health care professional is daunting [11].

4. OBESITY AND COVID-19

Obesity is increasing in post industrialized world day by day as the lifestyle changes are happening. Obesity is defined as having more weight as compared to height. Persons with body mass index (BMI) greater than 30 are generally called as obese. People with obesity have various other chronic illnesses which are very harmful to the internal mechanism of the body. Obese people also are more prone to catching the COVID-19 infection. The inflammation of low grade is always present among obese people and COVID-19 may aggravate it. In a study, almost 47.6 percent of infected people were obese of which 68.6 percent of them received ventilation. Obesity can cause diabetes, which is already discussed as worst diseases to have in COVID-19 pandemic. Hypertension is the extension of the obesity as blood vessels experience more strain in supply of blood. Management of COVID-19 infected obese people is also a challenge as various procedures such as x-ray, computed tomography (CT) scan are difficult and need more man power in case of these people [12].

5. CARDIOVASCULAR DISEASE AND COVID-19

Cardiovascular diseases are the group of diseases that are related to heart, arteries and veins and circulatory system. It includes coronary heart disease, congenital heart disease and so on. Heart attacks and strokes are covered under the cardiovascular disease term and happened due to blockage in arteries or blood vessels due to fatty substances. Cardiovascular diseases are the number one cause of which maximum number of people lost their lives annually. 17.9 million People died due to cardiovascular disease alone in the year 2016. Over 75 percent of total cardiovascular deaths occurring are from middle and low income countries which is an important fact to highlight. There are more than 523 million cases of cardiovascular diseases worldwide which is a separate cause of concern [13]. As these population are now vulnerable in current COVID-19 pandemic scenario, this data will act as guiding light in planning the mitigation measures. As this huge number of people are exposed to novel coronavirus which can exploit their immunosuppressive state, more attention can be given on how the disease is progressing in these patients. The gateway of the novel coronavirus to the host cell is the angiotensin-converting enzyme 2 (ACE 2) receptor. These are prominently expressed over important organs

like heart, which makes it more vulnerable to the adverse impact inflicted by the COVID-19. This can cause direct myocardial injury and weakening of cardiovascular muscles in infected persons. More severe patients show cytokine storm which can have long lasting impact on the cardiovascular system. Myocarditis is the prominent example of adverse impact of novel coronavirus. The similar outbreaks of severe acute respiratory syndrome (SARS) and Middle Eastern respiratory syndrome (MERS) also showed higher prevalence of cardiovascular disease among patients and case fatalities. A study conducted in the Wuhan suggested that 6.8 percent case fatalities from studies group of 191 patients were having cardiovascular disease. Another study raised this number to 17 percent. The compromised innate immune system is behind the worsening of the clinical outcomes of the COVID-19 patients. Quick and emergency care is needed to cardiovascular patients having COVID-19 to reduce severe symptoms and lethal outcomes [14].

6. LIVER DISEASES AND COVID-19

Liver diseases can be acute and chronic. Chronic liver diseases includes liver ailment like liver cirrhosis. The healthy tissues of the liver is replaced by bad tissues which then hinders with essential processes of human anatomy like taking out toxins, storing energy, producing bile and proteins. Liver damage can be caused by alcohol consumption, obesity. Abnormal liver function has been already seen in previous similar outbreaks of SARS and MERS. As previously said angiotensin-converting enzyme 2 (ACE 2) receptors are present on liver which act as a gateway to novel coronavirus to enter the host cell. In a study, 43.4 percent of COVID-19 patients were found having abnormal secretions of various enzymes such as aspartate amino transferase (AST) and lactic dehydrogenase (LDH). In another study, 29 percent patients of COVID-19 developed a liver injury in the course of severe COVID-19 condition [15]. The raised levels of ALT and AST can cause damage in later course of COVID-19. A cohort study from China among COVID-19 infected patients with liver diseases offers some valuable insights. 1099 patients with COVID-19 was studied 21 of them were found to be having preexisting hepatitis B. Elevation in ALT and AST levels were found to be among 21.3 and 22.2 percent of overall COVID-19 infected patients. 10.5 percent of them had bilirubin levels which were not considered normal [16].

7. COPD AND COVID-19

COVID-19 affects primarily the respiratory system. The novel coronavirus enters the human body through nose, mouth or any other openings and stays in respiratory pathways. Also chronic obstructive pulmonary disorder (COPD) is an inflammatory lung disease that hinders the air flow passage and smooth air flow in both the direction is not possible. COPD symptoms include shortness of breath, chronic cough. COPD and COVID-19 overlaps symptoms in many cases. According to WHO, 251 million cases of COPD were registered all across the world and this number is rising till date due to various reasons. The inflammations generated by the COPD in the airway obstruct the free flow oxygen and carbon dioxide. COPD is prevailing in major chunk of the admitted patients having COVID-19. Also it increases the chance of having COVID-19 pneumonia which is a prominent symptoms of deteriorating health condition. Acute respiratory distress syndrome (ARDS) can also kicked in provided the blocked airway. COPD is yet another comorbidity that a person should not have especially in the times of COVID-19 [17].

8. LONG TERM IMPLICATIONS

Comorbidities are the prime decider in deciding the course of clinical outcomes in COVID-19 patients. But the data coming out from discharged patients or survivors of COVID-19 suggest some long term implications for which health care infrastructure must be ready. Comorbidities can haunt the infected patient even after getting recovered from COVID-19. Comorbidities make the recovery slower and steadier. Worsening of symptoms have been found some times in the patients. Major amount of the case fatalities have been reported from comorbid patients. So in order to arrest the spread and lower the fatalities, comorbid patients must follow some preventive measures so that do not get infected at first place. Comorbid patients must be extra cautious as if they get infected, then the course of the infection is generally not on their side [18]. Various preventive measures can be adopted and followed by the comorbid patients so that they get safeguarded from the virus. Comorbid patients must not go out when not necessary as it will reduce the chances of infection by many percentage. Also being at home, one should maintain minimum and safe distance from the

comorbid patients as they are already in immunosuppressive state and can catch infections easily. Medications must be adequately stocked so that no lack should arise if lockdown like measures are imposed. Regular consultations with the use of technology such as telemedicine will immensely benefit the patient as this minimizes the risk and to doctor as he or she can attend many patients in less time [19]. Studies on different aspects of comorbidities like diabetes mellitus were reported [20-23]. Afaque reported on association and treatment of diabetes in patients affected by COVID-19 [24]. Similar studies on Covid and diabetes were reported [25-29]. Some key aspects of problems with diabetes management in this region were highlighted by few studies [30-34].

9. CONCLUSION

The comorbidity and its relation with clinical outcomes of COVID-19 has been successfully establishes. Now proper targeted plans should be chalked out for high risk categories so that daily infections can be lowered and case fatalities can be brought to nil. Also more nuanced aspects can be studied further categorically establishing the each disease's correlation with COVID-19 clinical outcomes. Various conditions like diabetes mellitus, liver diseases, and cardiovascular diseases are happening due to lifestyle changes and are grappling the world quite rapidly. It was alone a major problem until pandemic aggravated and compelled us to take note of it. For now containment of the lethal diseases must be the top priority and then for long term, these chronic illnesses must be tackled in a phase wise manner as this diseases take a huge toll on body's internal mechanism. Long term implications must be studied so that necessary infrastructure can be establish in due time. Preventive measures are the best option for the comorbid patients as it safe guard them from the diseases.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. COVID-19 Map [Internet]. Johns Hopkins Coronavirus Resource Center. [cited 2021 Feb 12]. Available: <https://coronavirus.jhu.edu/map.html>
2. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020.pdf.
3. WHO Coronavirus Disease (COVID-19) Dashboard [Internet]. [cited 2021 Feb 12]. Available from: <https://covid19.who.int>
4. Wise J. Covid-19: New coronavirus variant is identified in UK. *BMJ* [Internet]. 2020 Dec 16 [cited 2020 Dec 23];371:m4857. Available: <https://www.bmj.com/content/371/bmj.m4857>
5. Guan W-J, Liang W-H, Zhao Y, Liang H-R, Chen Z-S, Li Y-M, et al. Comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis. *Eur Respir J*. 2020;55(5).
6. Dushyant Bawiskar, Pratik Phansopkar, Ayurva Vilas Gotmare. COVID-19 Facets: Pandemics, Curse and Humanity. *IJRPS*. 2020;11(SPL1):385–90.
7. Yuki K, Fujiogi M, Koutsogiannaki S. COVID-19 pathophysiology: A review. *Clin Immunol* [Internet]; 2020. [cited 2020 Nov 24];215:108427. Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7169933/>
8. Callender LA, Curran M, Bates SM, Mairesse M, Weigandt J, Betts CJ. The Impact of Pre-existing Comorbidities and Therapeutic Interventions on COVID-19. *Front Immunol*. 2020;11:1991.
9. Bouhanick B, Cracowski J-L, Faillie J-L, French Society of Pharmacology, Therapeutics (SFPT). Diabetes and COVID-19. *Therapie*. 2020;75(4):327–33.
10. Erener S. Diabetes, infection risk and COVID-19. *Mol Metab* [Internet]. 2020 Sep [cited 2020 Dec 19];39:101044. Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7308743/>
11. Hussain A, Bhowmik B, do Vale Moreira NC. COVID-19 and diabetes: Knowledge in progress. *Diabetes Res Clin Pract* [Internet]; 2020 [cited 2020 Dec 19];162:108142. Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7144611/>
12. Allotey J, Stallings E, Bonet M, Yap M, Chatterjee S, Kew T, et al. Clinical manifestations, risk factors, and maternal and perinatal outcomes of coronavirus disease 2019 in pregnancy: living systematic review and meta-analysis. *BMJ* [Internet]. 2020 Sep 1 [cited 2021 Feb 2];370:m3320. Available: <https://www.bmj.com/content/370/bmj.m3320>
13. Cardiovascular diseases (CVDs) [Internet]. [cited 2021 Feb 11]. Available: [https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-\(cvds\)](https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds))
14. Bansal M. Cardiovascular disease and COVID-19. *Diabetes Metab Syndr* [Internet]; 2020 [cited 2021 Feb 11];14(3):247–50. Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7102662/>
15. Sun J, Aghemo A, Forner A, Valenti L. COVID-19 and liver disease. *Liver International* [Internet]. 2020 [cited 2021 Feb 12];40(6):1278–81. Available: <https://onlinelibrary.wiley.com/doi/abs/10.1111/liv.14470>
16. Wu J, Song S, Cao H-C, Li L-J. Liver diseases in COVID-19: Etiology, treatment and prognosis. *World J Gastroenterol* [Internet]. 2020 May 21 [cited 2021 Feb 11];26(19):2286–93. Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7243650/>
17. Leung JM, Niikura M, Yang CWT, Sin DD. COVID-19 and COPD. *European Respiratory Journal* [Internet]. 2020 Aug 1 [cited 2021 Feb 12];56(2). Available: <https://erj.ersjournals.com/content/56/2/2002108>
18. Yelin D, Wirtheim E, Vetter P, Kalil AC, Bruchfeld J, Runold M, et al. Long-term consequences of COVID-19: research needs. *The Lancet Infectious Diseases* [Internet]. 2020 Oct 1 [cited 2020 Dec 17];20(10):1115–7.

- Available:[https://www.thelancet.com/journals/laninf/article/PIIS1473-3099\(20\)30701-5/abstract](https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(20)30701-5/abstract)
19. Güner R, Hasanoğlu I, Aktaş F. COVID-19: Prevention and control measures in community. *Turk J Med Sci.* 2020;50(SI-1):571–7.
 20. Raja KK, Inamdar AH, Lahole S, Palsodkar P. “Prevalence of Non-Alcoholic Fatty Liver Disease in Prediabetes and Diabetes.” *International Journal of Pharmaceutical Research* 2019; 11(3):1424–27.
Available:<https://doi.org/10.31838/ijpr/2019.11.03.166>.
 21. Daniel V, Daniel K. Diabetic neuropathy: new perspectives on early diagnosis and treatments. *Journal of Current Diabetes Reports.* 2020;1(1):12-14.
Available:<https://doi.org/10.52845/JCDR/2020v1i1a3>
 22. Subhadarsanee C, PV. Dhadse, V Baliga, and K. Bhombe. “Coronavirus Disease and Diabetes – Interplay of Two Pandemics.” *International Journal of Research in Pharmaceutical Sciences* 2020; 11(1):1048–53.
Available:<https://doi.org/10.26452/ijrps.v11i1SPL1.3443>.
 23. Unnikrishnan B, Rathi P, Bhat SK, Nayak PH, Ravishankar N, Singh A, Praveen O. “Risk Factors of Gestational Diabetes Mellitus: A Hospital-Based Pair-Matched Case-Control Study in Coastal South India.” *South African Journal of Obstetrics and Gynaecology* 2020;26(1):13–17.
Available:<https://doi.org/10.7196/SAJOG.2020.v26i1.1518>.
 24. Wagh SP, Bhagat SP, Bankar N, Jain K. “Role of Vitamin-c Supplementation in Type II Diabetes Mellitus.” *International Journal of Current Research and Review* 2020;12(13):61–64.
Available:<https://doi.org/10.31782/IJCRR.2020.121311>.
 25. Daniel V, Daniel, K. Perception of Nurses’ Work in Psychiatric Clinic. *Clinical Medicine Insights*, 2020;.1(1):27-33.
Available:<https://doi.org/10.52845/CMI/2020v1i1a5>
 26. Afaque SY. “Association and Treatment of Diabetes in Patients Affected by COVID-19.” *International Journal of Research in Pharmaceutical Sciences* 2020;11(1): 1198–1201.
Available:<https://doi.org/10.26452/ijrps.v11i1SPL1.3591>.
 27. Daniel V, Daniel K. Diabetic neuropathy: new perspectives on early diagnosis and treatments. *Journal of Current Diabetes Reports*,2020; 1(1):12–14.
Available:<https://doi.org/10.52845/JCDR/2020v1i1a3>
 28. Agrawal D, Jaiswal P, Goyanka B. “Diabetes and Covid-19: A Review.” *International Journal of Research in Pharmaceutical Sciences* 2020;11(1):376–79.
Available:<https://doi.org/10.26452/ijrps.v11i1SPL1.2729>.
 29. Padole VS, Kalsait RP, Ambad R, Kute P. “Effect of COVID 19 Affecting Geriatric Patients.” *International Journal of Current Research and Review* 2020;12(17):182–87.
Available:<https://doi.org/10.31782/IJCRR.2020.121729>.
 30. Pandhare S, Khan MB. “COVID – 19: A Pandemic Disease and Its Relation to Pranavahasrotas (Respiratory System)-a Review.” *International Journal of Research in Pharmaceutical Sciences.* 2020;11(1): 1298–1302.
Available:<https://doi.org/10.26452/ijrps.v11i1SPL1.3623>.
 31. Daniel V, Daniel K. Exercises training program: It’s Effect on Muscle strength and Activity of daily living among elderly people. *Nursing and Midwifery* 2020;1(01): 19-23.
Available:<https://doi.org/10.52845/NM/2020v1i1a5>
 32. Gaidhane S, Khatib N, Zahiruddin QS, Gaidhane A, Kukade S, Zodpey S. “Perceptions of Primary Care Doctors towards Type 2 Diabetes Mellitus and Challenges for Care at Primary Care Level in India.” *International Journal of Diabetes in Developing Countries* 2015;35(1):14–18.
Available:<https://doi.org/10.1007/s13410-014-0199-6>.
 33. Khatib NM, Quazi ZS, Gaidhane AM, Waghmare TS, Goyal RC.. “Risk Factors of Type-2 Diabetes Mellitus in Rural Wardha: A Community Based Study.” *International Journal of Diabetes in Developing Countries* 2008;28(3):79–82.
<https://doi.org/10.4103/0973-3930.44077>.
 34. Mohammad Akther J, Ali Khan I, Shahpurkar VV, Khanam N, Quazi Syed Z.

"Evaluation of the Diabetic Foot According to Wagner's Classification in a Rural Teaching Hospital." British Journal of Diabetes and Vascular Disease 2011;

11(2):74–79.
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