

Strategies for Controlling Diabetes Mellitus in Adolescents through a Family Approach at Puskesmas after the COVID-19 Pandemic

Amaze Grace Sira¹, Lorry Priskila^{1*}, Hendi Wicaksono¹, Mario Hendrian Simanjuntak¹, Angela Aletha Biatrix Nappoe¹, Dayceline Helena¹

*Correspondence: lorry@staff.ukdw.ac.id

¹Fakultas Kedokteran Universitas Kristen
Duta Wacana, Jl. Dr. Wahidin
Sudirhusodo no. 5-25, Gondokusuman,
Yogyakarta

Submission April 23, 2025

Accepted October 09, 2025

Available online on October 10, 2025

©2024 The Authors. Published by Stem Cell
and Cancer Research, Semarang, Indonesia.
This is an open-access article under the terms
of the Creative Commons Attribution-
NonCommercial-ShareAlike License (CC BY-NC-
SA 4.0), which permits unrestricted use,
distribution, and reproduction in any medium,
provided the original author and source are
credited.

ABSTRACT

Background: Non-communicable diseases (NCDs) have become a burden on the health system in Indonesia in recent years. The increasing prevalence of diseases such as heart disease, diabetes mellitus, and cancer has an impact on national health financing, and people's quality of life. This study is a literature review that aims to evaluate the relationship between NCD risk factors, the impact of the COVID-19 pandemic on early detection of chronic diseases, and the role of primary health facilities and family approaches in controlling NCDs. **Methods:** Secondary data were obtained from various scientific journals and official reports through systematic searches in Clinical Key, Google Scholar, and PubMed. **Discussion:** The review showed that risk factors such as body mass index (BMI), unhealthy diet, low physical activity, and family history significantly contributed to the increase in NCD cases. The COVID-19 pandemic has also caused serious disruptions to preventive health services, including decreased access to early detection of Type 2 Diabetes Mellitus Programs such as Posbindu PTM and PIS-PK conducted by Puskesmas have an important role in promotive and preventive efforts, although they are still faced with various obstacles. The family approach in implementing healthy living behaviors and early detection has proven crucial in supporting the success of NCD control. **Conclusion:** The integration of the family approach in the national NCD control strategy needs to be strengthened to improve the effectiveness of interventions and the quality of life of the community.

Keywords: Non-Communicable Disease, Risk Factor, Family Approach

INTRODUCTION

Non-communicable diseases (NCDs) have become a health problem in Indonesia in recent years. Data from the Indonesia Health Survey 2023 shows a significant increase in the prevalence of heart disease, diabetes, and cancer, putting a burden on national health financing but also impacting the overall quality of life of the community.¹ Based on Basic Health Research (RISKESDAS) data, diabetes mellitus has also increased in prevalence from 6.9% in 2013 to 8.5% in 2018 and continues to increase. Meanwhile, cancer cases also continue to grow, with the incidence reaching 136.2 per 100,000 population, putting Indonesia in an alarming position on the global map of NCD handling. WHO data in 2018 shows that 73% of deaths in Indonesia are caused by NCDs consisting of cardiovascular (35%), cancer (12%), chronic respiratory diseases (6%), diabetes (6%), and the risk of premature death is more than 20%. This shows that handling NCDs in Indonesia needs to be a concern.

Various interrelated factors strongly influence the causes of the increasing prevalence of NCDs in Indonesia. The main risk factors include high smoking habits, unhealthy diets such as excessive consumption of sugar, salt and fat, and low physical activity (sedentary lifestyle) in the community.²

Families play an important role in NCD prevention, as they are the primary small community. Nutritional patterns, parenting, and physical activity levels practised within the family directly influence the risk profile of family members for NCDs. Genetic predisposition is also a significant factor, with individuals with a family history of NCDs showing increased susceptibility to the condition. Despite this, health education and family awareness regarding early screening and preventive interventions for NCDs is still lacking in many parts of Indonesia. The lifestyle of Indonesians has undergone drastic changes in recent decades.³ Consumption of fast food and ultra-processed food is increasing, especially among the younger generation. People's physical activity is decreasing due to the increase in transportation capital and the use of gadgets, making people reluctant to do physical activity. This has a negative impact on the quality of individual health, characterized by an increase in BMI, especially in adolescents.⁴

The COVID-19 pandemic caused by the SARS-CoV-2 virus has had a significant impact on the health system, including early detection services for chronic diseases such as Type 2 Diabetes Mellitus (T2DM). Mobility restrictions, delays in routine check-ups, and a shift in the focus of health services to handling COVID-19 may lead to a decrease in the early detection of T2DM cases. It is necessary to understand the relationship between the COVID-19 pandemic and early detection of T2DM as an effort to conduct early detection and prevention of T2DM cases.^{5,6} Puskesmas, as a first-level health facility, has a strategic role in controlling NCDs. The promotive and preventive functions of Puskesmas are essential in the early detection of NCD risk factors through the Posbindu PTM (Pos Integrated Coaching for Non-Communicable Diseases) program. However, there are still several obstacles in terms of the capacity of health workers, availability of equipment and medicines, and service coverage, especially in remote areas. The role of community health centres in managing NCDs is key to reducing the burden of disease and improving the quality of life of Indonesians. This study was conducted to describe the relationship between risk factor control strategies along with NCDs and the role of health centres in efforts to improve the quality of life of NCD patients.⁷

METHODS

Search Strategy and Information Sources

The literature search method used was a literature review, systematically reviewing studies, journals, and literature relevant to the research topic. The search engines used were Clinical Key, Google Scholar, and PubMed. Keywords used were “non-communicable diseases,” “risk factors,” “quality of life,” “cardiovascular,” “diabetes mellitus,” “post-pandemic,” and “Posbindu.”

RESULT AND DISCUSSION

Overview of post-COVID-19 Adolescent BMI

Research conducted in Indramayu showed no relationship between body mass index levels and body mass index values. It was found that out of 40 students of SMK Teladan Indramayu, those with a BMI below normal were 42.5%, those with a normal BMI were 40%, and those with a BMI more than normal or obese were 17.5%. The blood sugar examination found that 62.5% of adolescents had blood sugar <100 mg/dL and that % had blood sugar >200mg/dL was 37.5%. The

blood sugar levels showed that blood sugar levels were normal and had no relationship with body mass index. This study has limitations in one variable, obesity because diabetes mellitus is a disease with multifactorial aetiology that can be genetic and environmental. Other indicators, such as abdominal circumference and hip circumference, can be assessed to see the condition of central obesity, which has a close relationship with metabolic disorders and cardiovascular risk.⁸

Another study in Yogyakarta by Ramadhani et al 2023 showed that out % of 34 adolescents, 8.8% had a BMI less than usual, 61.8% had a normal BMI, and 29.4% had a BMI above normal. Examination of blood sugar levels obtained 17.6% of those with normal blood sugar levels, 79.4% with prediabetes blood sugar levels, and 2.4% with diabetic blood sugar levels. This study noted that 23 respondents with normal BMI had blood sugar levels in the prediabetes category (47.1%), and nine respondents with BMI above normal had prediabetes blood sugar levels. This shows that BMI is not the only factor that affects blood sugar levels; there are other factors, such as an unhealthy diet and poor physical activity. There was a very weak correlation between blood sugar levels and BMI (p-value = 0.495).⁹ Increased BMI at a young age increases the risk of type 2 diabetes mellitus in the elderly. Research by Kurniawati et al. (2023) on 80 older women. In this study, it is said that beyond the BMI value, female respondents have a higher risk than men. BMI in the elderly tends to be lower than the normal value due to the degeneration process in the elderly body. The better the IMT value, the lower the person's eloping type 2 DM. In this case, it was found that BMI was less than normal 6.3%, those with normal BMI were 36.3%, and those with BMI more than normal 57.5%. The risk of developing type 2 DM is very low 73.8%; 18.8% have moderate risk factors and have a high risk of 7.5%. The results of this study indicate that there is a significant relationship between BMI and the risk of type 2 DM with a very weak correlation.¹⁰

A similar thing was found at the Cempaka Putih Health Center in Banjarmasin City in 2020. In this study, 23% of respondents aged 20-35 years and 77% aged >35 years. In this study, it was found that out of 42 respondents who had a BMI above normal, 30 people (71.4%) had blood sugar levels above normal or diabetes, and as many as five people (11.9%) had prediabetes and seven people (16.7%) had normal blood sugar levels. Research obtained the results from 66 respondents who had a family history of diabetes; there were 28 people (42.2%) who had high blood sugar levels or diabetes, then there were 24 people (36.4%) with prediabetes, and there were 14 people (21.2%) with normal respondents.¹¹ Risk factors for type II diabetes mellitus in adolescents are generally related to lifestyle and genetic factors. In the case group, 63.6% of respondents had a high-risk category BMI (≥ 25 kg/m²). In the case group, 42.4% of respondents had a high-risk category BMI; the chance of developing diabetes mellitus in adolescents who have a high-risk category BMI is 2.38 times greater than the chance of developing diabetes in adolescents who have a low-risk category BMI. The family history risk analysis found that the family history variable was associated with the incidence of diabetes mellitus in adolescents with a risk of 5.89. The chance of developing diabetes mellitus in adolescents who have families with type 2 diabetes mellitus is 5.89 times greater than the chance of developing diabetes in adolescents who do not have family diabetes mellitus.¹²

Early Detection of Post-COVID NCDs

Based on the explanation above about the increase in BMI and the condition of type II diabetes mellitus. Diabetes mellitus is a threat to the next generation, followed by sedentary lifestyle changes. Although included in non-communicable diseases, DM conditions will affect conditions when experiencing infectious diseases such as COVID-19. COVID patients with comorbid Diabetes Mellitus are the most common diseases found, especially in hospitalized COVID-19 patients, and contribute to an increased risk of severity and death. Although it does not increase the risk of SARSCoV-2 infection, diabetic patients experience a worse disease course due to various factors

such as hyperglycemia, impaired metabolic control, and microvascular damage. The presence of obesity, hypertension, and cardiovascular disease exacerbates this condition. In addition, intensive care, such as administering high doses of glucocorticoids, can also worsen glucose levels and require insulin adjustment.^{5,6}

Based on research conducted in Indonesia, there is a relationship between the COVID-19 pandemic and early detection of T2DM. Research by Husain et al. (2022) in a family doctor practice in Manado City reported a prevalence of T2DM of 28.64% during the pandemic, with the majority of patients over 65 years and female. In COVID-19 patients who were admitted and had T2DM, there was an increased need for mechanical ventilation, ICU care, and length of hospitalization. A study from the UK showed that 32% of COVID-19 patients who died had T2DM, and mortality rates increased in those with HbA1c >10%. Interestingly, too low HbA1c was also associated with a higher mortality risk, indicating the importance of glycemic stability.¹³ Based on a retrospective cohort study conducted by Yan Xie et al. (2022) showed that individuals infected with SARS-CoV-2 had a 40% higher risk of developing diabetes within 12 months post-infection, compared to the non-COVID control group, meaning there is a direct effect of COVID-19 on diabetes risk. The suspected mechanisms involved are pancreatic beta cell damage, insulin resistance due to systemic inflammation, and the effect of steroid therapy during COVID-19 treatment.

SARS-CoV-2 infection in individuals with diabetes can cause pancreatic β -cell damage. β -cell damage will disrupt glucose homeostasis, causing hyperglycemia. A cytokine storm will also occur and will further cause insulin resistance, especially in the muscles and liver, which also results in hyperglycemia. All of these can increase the severity of COVID-19. Individuals with diabetes will have an intrinsic susceptibility to infection. Some factors can influence disease severity, such as environmental factors, host nutritional status, and diseases such as hypertension, COPD, cardiovascular disease, and renal impairment.^{5,6,14} Pandemics cause major changes in access to healthcare, especially in resource-constrained settings. Patients with high-risk diabetes will experience decreased access to medical consultations and medications. This will worsen glucose control for patients with diagnosed diabetes and will also lead to new cases of T2DM not being detected early.⁶

NCD Control Program in Indonesia

The increasing prevalence of NCDs nationally and globally encourages the need for a comprehensive and sustainable risk control strategy through promotive, preventive approaches and strengthening the role of primary healthcare facilities. NCDs have been recognized as one of the priority health issues in Indonesia, given their significant contribution to morbidity and mortality rates. The government has begun to develop and implement strategies to prevent and control NCDs in a targeted and sustainable manner.³ Prevention and control of NCD risk factors are divided into four ways, namely first through advocacy, cooperation, guidance and management of NCDs, second through promotion, prevention, and reduction of NCD risk factors through community empowerment, the third through strengthening the capacity and competence of health services, as well as private and professional sector collaboration, and the last is strengthening NCD surveillance, monitoring, and research.¹⁵

The NCD control program in Indonesia itself is prioritized on the four-by-four strategy, which aligns with WHO recommendations in the Global Action Plan for the Prevention and Control of NCDs 2013-2020. This approach focuses on four major NCDs that cause death: cardiovascular disease, diabetes mellitus, cancer and chronic obstructive pulmonary disease. It focuses on four shared risk factors: unhealthy diet, physical inactivity, smoking and alcohol consumption.^{9,15,16}

Efforts to achieve the target indicators of NCD control are carried out by implementing policy measures and strategies to prevent and control NCDs. Strategic steps begin with empowering the community to adopt a healthy lifestyle to prevent exposure to NCD risk factors, followed by increasing access to quality health services, increasing partnerships with cross-programs and cross-sectors, implementing NCD surveillance that is developed in an integrated manner, and increasing advocacy to local governments, village governments, and stakeholders to support NCD control policies sustainably.^{7,17}

NCD risk control strategies have been designed and developed in a structured manner through various programs initiated by the Ministry of Health. These programs include promotional efforts to increase public awareness, prevent risk factors such as unhealthy diet and smoking, and early detection through screening for certain diseases. A treatment program for patients already diagnosed with NCDs involves training health workers and implementing smoke-free areas. Two main programs have been implemented to control the risk of NCDs in Indonesia, namely the Integrated Coaching Post (Posbindu) Program and the Healthy Indonesia Program with a Family Approach (PIS-PK). Posbindu aims to conduct early detection and prevention of NCDs, such as diabetes mellitus and hypertension, through health screening activities and counselling on risk factors. This program involves the community's active role as agents of change in encouraging healthy living behaviour, which is expected to reduce the prevalence of NCDs. Meanwhile, PIS-PK is a primary care-based program at puskesmas that focuses on monitoring the overall health condition of families. This program is also supported by cross-sectoral cooperation and various related organizations to strengthen the effectiveness of integrated NCD control.¹⁵⁻¹⁷

In implementing the Non-Communicable Disease (NCD) control program, various obstacles still affect the effectiveness of prevention efforts. One of the obstacles is related to the limited budget allocated for promotive and preventive activities. In addition, the availability of data and information on NCD risk factors from the health information system is still inadequate, hampering the program planning and evaluation process. Lack of support from local governments and cross-sector involvement are also obstacles in supporting overall policy implementation. On the other hand, the community's low understanding of NCDs is also an obstacle to building healthy behaviour change. The limited number of health workers and researchers in this field is also a factor that weakens the effectiveness of program implementation. It focuses on four shared risk factors: unhealthy diet, physical inactivity, smoking and alcohol consumption.^{9,15,16}

Efforts to achieve the target indicators of NCD control are carried out by implementing policy measures and strategies to prevent and control NCDs. Strategic steps begin with empowering the community to adopt a healthy lifestyle to prevent exposure to NCD risk factors, followed by increasing access to quality health services, increasing partnerships with cross-programs and cross-sectors, implementing NCD surveillance that is developed in an integrated manner, and increasing advocacy to local governments, village governments, and stakeholders to support NCD control policies sustainably.^{7,17}

The effectiveness of the family role is also seen through the support provided, both motivationally, emotionally, and in action, to family members who suffer from NCDs. Families play a role in monitoring health conditions, adherence to treatment, and creating an environment that supports healthy behaviors, such as providing nutritious food and encouraging physical activity.^{9,15} Families have a strategic role in the early detection of NCD symptoms because the knowledge and awareness of family members can accelerate the recognition of early signs of disease so that treatment can be carried out more quickly and appropriately. Family involvement in community-based health programs, such as Posbindu PTM, has also been shown to increase the effectiveness of disease control and the quality of life of people with NCDs. Given the important role of the family in maintaining

individual health, the family approach becomes the main foundation in the implementation of PIS-PK, which emphasizes the identification of risk factors and household-based early intervention.^{7,18,19}

CONCLUSION

Controlling NCD risk factors through a family approach is crucial in sustainable promotive and preventive efforts. Families have a strategic position in shaping healthy living behaviours, encouraging early detection, and increasing compliance with disease management. By integrating the role of families into health programs such as PIS-PK and Posbindu PTM, efforts to control risk factors become more holistic and effective. Therefore, family empowerment as an active partner in preventing and controlling NCDs needs to be continuously strengthened to improve the overall quality of life in the community.

REFERENCES

1. RI, Kementerian Kesehatan. Survei Kesehatan Indonesia 2023. <https://www.badankebijakan.kemkes.go.id/hasil-ski-2023/>
2. Tim Riset Kesehatan Dasar 2018 (Indonesia), Indonesia, eds. *Laporan Nasional Riskesdas 2018*. Kementerian Kesehatan, Republik Indonesia, Badan Penelitian dan Pengembangan Kesehatan; 2019.
3. Al-Noumani H, Al-Harrasi M, Al Zaabi O, Natarajan J. Predictors of health-related quality of life in patients with non-communicable diseases: A national cross-section study. *Applied Nursing Research*. 2022;64:151566. doi:10.1016/j.apnr.2022.151566
4. Mescoloto SB, Pongiluppi G, Domene SMÁ. Ultra-processed food consumption and children and adolescents' health. *J Pediatr (Rio J)*. 2024;100 Suppl 1(Suppl 1):S18-S30. doi:10.1016/j.jped.2023.09.006
5. Ghosh A, Arora B, Gupta R, Anoop S, Misra A. Effects of nationwide lockdown during COVID-19 epidemic on lifestyle and other medical issues of patients with type 2 diabetes in north India. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*. 2020;14(5):917-920. doi:10.1016/j.dsx.2020.05.044
6. Nabi AHMN, Ebihara A, Shekhar HU. Impacts of SARS-CoV-2 on diabetes mellitus: A pre and post pandemic evaluation. *World J Virol*. 2023;12(3):151-171. doi:10.5501/wjv.v12.i3.151
7. Wahidin M, Agustiya RI, Putro G. Beban Penyakit dan Program Pencegahan dan Pengendalian Penyakit Tidak Menular di Indonesia. *Jurnal Epidemiologi Kesehatan Indonesia*. 2023;6(2). doi:10.7454/epidkes.v6i2.6253
8. Toruan SAL, Manu TT. HUBUNGAN INDEKS MASA TUBUH DENGAN KADAR GULA DARAH SEWAKTU PADA SISWA SMK TELADAN INDRAMAYU. doi:<https://doi.org/10.31004/jkt.v5i3.28829>
9. Ramadani A, Anggraeni FD. Hubungan Antara Indeks Massa Tubuh (IMT) Dengan Gula Darah pada Remaja di SMA Muhammadiyah 7 Yogyakarta. doi:<https://doi.org/10.55340/kjkm.v6i2.1313>

10. Kurniawaty Y. HUBUNGAN INDEKS MASSA TUBUH DENGAN RISIKO DIABETES MELLITUS TIPE 2. *Media ilmu kesehatan*. 2021;9(3):237-242. doi:10.30989/mik.v9i3.508
11. Norsaipah N. HUBUNGAN INDEKS MASSA TUBUH DAN RIWAYAT KELUARGA DENGAN KEJADIAN DIABETES MELITUS PADA MASYARAKAT DI PUSKESMAS CEMPAKA PUTIH KOTA BANJARMASIN TAHUN 2020. <https://eprints.uniska-bjm.ac.id/2429/>
12. Yahya AA, Arsin AA, Ayu RD. FAKTOR RISIKO DIABETES MELITUS TIPE II PADA REMAJA DI PUSKESMAS LAYANG DAN PUSKESMAS ANTARA. doi:<https://doi.org/10.51171/jms.v14i2.496>
13. Husain AA, Rombot VD, Porajow ZCJG. Prevalensi diabetes melitus tipe 2 pada masa pandemi COVID-19 di praktik dokter keluarga Kota Manado. <https://ejournal.unsrat.ac.id/v3/index.php/JKKT/article/view/44879>
14. Xie J, Ding S, Zhang X, Li X. Impact of a patient safety leadership program on head nurses and clinical nurses: a quasi-experimental study. *Revista Latino-Americana de Enfermagem*. 2021;29:e3478. doi:10.1590/1518-8345.4328.3478
15. Choirunnisa F. Peran Keluarga Dalam Upaya Pencegahan Risiko Penyakit Tidak Menular (PTM) Hipertensi Melalui Perilaku CERDIK di RT 03 RW 02 Kelurahan Pandanwangi. doi:10.31290/jphp.v1i1.4243.
16. Sadarang RAI, Sugiarto S, Kusnanto H. Analisis Situasi Masalah Program Pengendalian Penyakit Tidak Menular di Kabupaten Kulon Progo Daerah Istimewa Yogyakarta Tahun 2016. *JDK*. 2021;10(1):75-84. doi:10.33024/jdk.v10i1.3523
17. RI, Kementerian Kesehatan. Rencana Aksi Kerja Kegiatan Direktorat P2PTM 2021-2024 (Revisi 1). (<https://p2p.kemkes.go.id/wp-content/uploads/2024/03/RAK-Dit-P2PTM-1-465827-02-4tahunan-070.pdf>)
18. Haris RNH, Makmur R, Andayani TM, Kristina SA. Penilaian Properti Psikometrik Instrumen Kualitas Hidup (HRQol) pada Populasi Umum: Tinjauan Sistematis. *J Manaj dan Pelayanan Farm*. 2019;9(2). doi:10.22146/jmpf.41911
19. Cini KI, Wulan NR, Dumuid D, et al. Towards responsive policy and actions to address non-communicable disease risks amongst adolescents in Indonesia: insights from key stakeholders. *The Lancet Regional Health - Southeast Asia*. 2023;18:100260. doi:10.1016/j.lansea.2023.100260