BKM Public Health & Community Medicine
Berita Kedokteran Masyarakat

Volume 40 **Number** 9, 2024, **Pages** e10958
DOI: 10.22146/bkm.v40i09.10958

Map of the distribution of diabetes mellitus cases and their treatment in the number of health workers and primary health care in Yogyakarta City District 2020

Yuni Laferani[1]*, Ni Nengah Sri Kusumadewi[2]

Submitted:
November 27th, 2023
Accepted:
September 25th, 2024
Published:
September 30th, 2024

[1]Public Health Science Program Study, Faculty of Health Science, Universitas Siliwangi, Tasikmalaya, Indonesia

[2]Public Health Science Program Study, Department of Biostatistics and Population Studies, Faculty of Public Health, Universitas Indonesia, Indonesia

***Correspondence:**
yunilaferani@unsil.ac.id

Abstract

Purpose: One of the non-communicable diseases with the highest incidence rate at the global level is diabetes. The percentage of diabetes cases in Indonesia increased from 6.9% in 2013 to 10.9% in 2018. The Indonesian government, through the Ministry of Health, has made efforts to overcome diabetes due to the increasing incidence of diabetes. This study aims to describe the number of diabetes mellitus cases, the distribution map of health facilities, and various elements of the diabetes mellitus management program in Yogyakarta City in 2020. **Methods:** Descriptive analysis with quantitative approach using aggregate data at the sub-district level in Yogyakarta City. Data analysis using QGIS applications. **Results:** Distribution is shown by classifying the number of cases and the percentage of different diabetes cases in the sub-district, which is described by elements of diabetes management programs. **Conclusion:** The distribution of diabetes cases is based on the number of cases with the highest categories in the sub-districts of Umbulharjo, Gondokusuman, and Tegalrejo. Pakualaman sub-district has a very high percentage of diabetes cases coupled with intermediate accreditation status, the number of posbindu is 6-8, the number of nurses is less than 5, the number of health cases, and the number of medical laboratory technology is only one.

Keywords: diabetes mellitus; distribution; health workers; management

INTRODUCTION

Over the past few decades, the double burden of world epidemiology has shifted from infectious diseases to non-communicable or non-communicable diseases. The World Health Organization (WHO) states that globally, about 40 million deaths each year are caused by non-communicable diseases, or equivalent to 70% of deaths from all causes globally [1]. One of the non-communicable diseases with the highest incidence rate at the global level is diabetes. The International Diabetes Federation (IDF) estimates that around 463

million or 9.3% of 20-79-year-olds in the world have diabetes. This figure is predicted to increase to 578 million in 2030 and 700 million in 2045. Indonesia entered the top 10 and ranked 7th for the highest number of people with diabetes worldwide in 2019 [2].

The percentage of diabetes cases increased from 6.9% in 2013 to 10.9% in 2018. The diabetes death rate in Indonesia reached 236 thousand in 2021, an increase of 58% compared to 2011 [3]. Diabetes Mellitus D.I. Yogyakarta (2.6%) ranks second highest in cases in Indonesia after DKI Jakarta. Yogyakarta City ranks first for the incidence of Diabetes in Yogyakarta province, with the highest number attacking the age of 45-74 years (22.49%) with the highest age group of 65-74 years (9.31%) [4]. In the period from January to August 2022, the number of deaths in Yogyakarta City due to diabetes was 61 cases, and it became a degenerative disease that caused death at the top of the list.

Through the Ministry of Health, the Indonesian government has made efforts to overcome diabetes because the incidence of diabetes continues to increase; it is prevention and control efforts [1]. Control efforts consist of various programs, one of which is the Indonesian government through the Social Security Administration Agency (BPJS) launching a program for Diabetes control called the Chronic Disease Control Program (PROLANIS). This program is an integrated health program between patient communities, health workers, health facilities, and BPJS so that it can be carried out in essential services such as primary health care. The requirement to join this program is that the participant is diagnosed with diabetes and registered in BPJS [5].

In Yogyakarta City, the number of participants in the National Health Insurance is quite good, amounting to 396,746 or around 95.62% of the total population [6]. Prolanis activities include medical consultations, Short Message Service gateway reminders, home visits, health status monitoring, participant education, and gymnastics club activities [7]. In this activity, the role of health workers (doctors, midwives, and nurses), community health workers, and medical technical personnel is needed. Community participation and empowerment through the implementation of Posbindu is also included in the diabetes control program in Indonesia, considering the highest number of cases attacking at the age of 45-74 years. Other programs include the availability of laboratories to check blood glucose levels in primary health care [8].

The success of programs run by health facilities is essential to improving the quality of health services and affecting the accreditation of puskesmas. Accreditation of puskesmas by Permenkes No. 46 of 2015 is divided into several levels, essential, intermediate, main, and plenary accreditation. Some of the above control programs are expected to reduce the number of diabetes cases. Affordability and ease of access to health facilities also influence diabetes control programs. In line with research conducted by Salam and Wahyono, it is stated that distance and access to health facilities affect the incidence of disease [9].

In the technological era, these obstacles can be solved with Geographic Information Systems (GIS). A system based on computer technology can carry out the process of entering, storing, manipulating, displaying, and issuing geographical information. Analysis in GIS approaches by managing geographical situations related to population, distribution, health, environment, behavior, and social [10,11]. Medical GIS identifies and maps populations, health problems, risk factors, and their relationship. GIS is a helpful tool for planning and implementing public health programs. However, research that used this analysis can determine the distribution and affordability of particular objects to be able to determine the distribution of diabetes cases, the distribution of the number of health workers (Doctors, Midwives, and Nurses), community health workers, medical technicians, laboratory availability and the affordability of primary health care in Yogyakarta is not widely studied yet.

METHODS

This research is descriptive with an equity approach that uses aggregate data at the sub-district level in Yogyakarta City, specifically data from the 2020 Yogyakarta Province health profile. There are 14 sub-districts in Yogyakarta City. This study aims to describe the number of diabetes mellitus cases in Yogyakarta City and provide a map of the distribution of health facilities, affordability of services, and various elements of diabetes mellitus management programs in Yogyakarta City in 2020. The variables used in this study are the total number of cases of Diabetes Mellitus, the number of all primary health care and accreditation status, the number of posbindu, the number of health workers (Doctors, Midwives, Nurses), the number of public health workers, the number of medical technicians, and the number of medical lab technology in the Yogyakarta City area in 2020.

The types of data used are aggregate and spatial data in the form of mapping the Yogyakarta City area and coordinate points for the location of all Puskesmas in Yogyakarta City in 2020. Meanwhile, the data source from this study uses data from the Health Profile of Yogyakarta City in 2020. Data display using buffering

and overlay techniques in the QGIS application to determine the affordability and distribution pattern of puskesmas in Yogyakarta City. The classification of disease distribution, the number of posbindu, the number of doctors, midwives, nurses, medical engineering, public health, and the number of medical laboratory technologies uses the Quartile division, where data is divided into four categories.

RESULTS

Yogyakarta City is one of the five regencies/cities in Yogyakarta province. It administratively has 14 sub-districts and 45 kelurahan areas, and its population was 416,041 in 2019. The number of diabetes mellitus cases in Yogyakarta City in 2020 was 10,635, spread across 14 districts. In Figure 1 the number of Diabetes cases is classified by quartile to produce four categories low, medium, high, and very high. Meanwhile, the affordability of primary health care is divided into two parts, the reach with a radius of 500 m and a radius of 1000 m. The distribution of diabetes cases is very high in 3 districts, Tegalrejo. In the Tegalrejo area, which has a radius of 500 m from primary health care, more than half of the area is not reached even with the help of primary health care from other sub-districts. However, if the range is expanded by 1000 m, then almost the entire area can be covered; a small part that needs to be covered is in the northwestern part of the Tegalrejo area. Gondokusuman and Umbulharjo sub-districts have a radius of 500 m, and more than 60% of the area needs to be covered.

The coverage of the primary health care in Gondokusuman and Umbulharjo sub-districts was expanded by 1000 m, so there are still areas that need to be covered, the northeastern part of Gondokusuman and the southern part of Umbulharjo. The distribution of the lowest diabetes cases is in Gedongtengen, Wirobrajan, and Pakualaman sub-districts. When viewed on the map, the three sub-districts can access puskesmas with a radius of 500 m, and even primary health care in neighboring areas, such as Pakualaman District, can reach Danurejan and Gondomanan health centers with a radius of 500 m.

The mapping results in Figure 2 show the percentage of diabetes cases resulting from the number of cases divided by the population so that four categories are low, medium, high, and very high. The percentage of diabetes with a low category is only in 2 sub-districts, Wirobrajan and Gedongtengen sub-districts, with a radius of 500 m. Meanwhile, very high cases are presented in the Pakualaman, Danurejan, and Jetis sub-districts. Not all areas are covered by these three sub-districts when viewed within a radius of 500 m from the sub-district health center. However, if the radius is enlarged to 1000 m, all areas are 100% covered, although puskesmas assist in this coverage in other sub-districts.

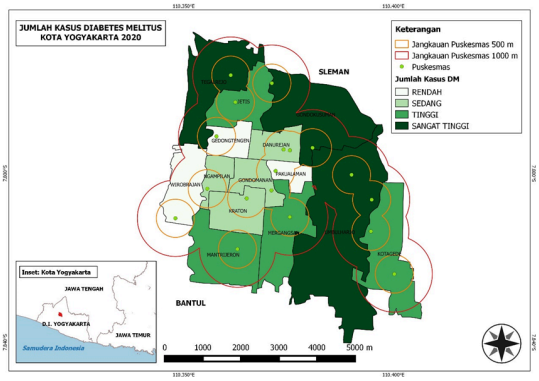

Figure 1. Distribution and affordability of the number of diabetes mellitus cases

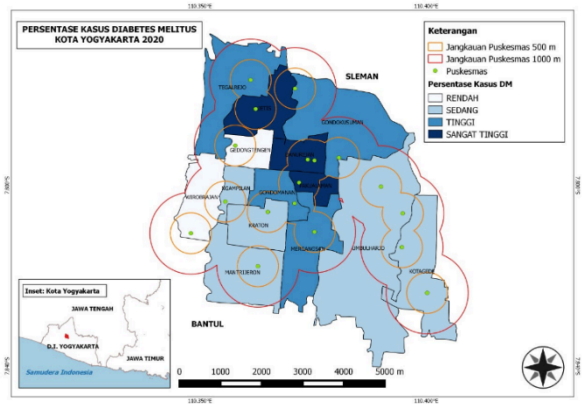

Figure 2. Distribution of diabetes case percentage and affordability of primary health care

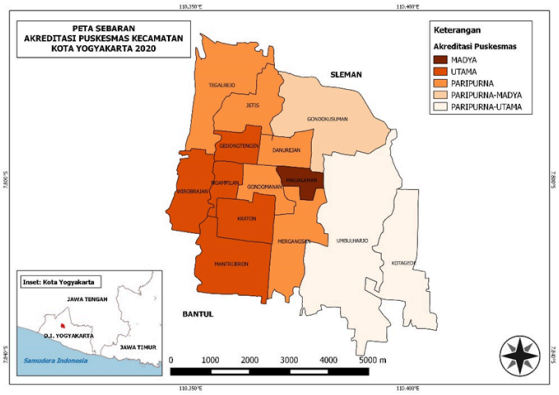

Figure 3. Map of accreditation distribution of puskesmas Yogyakarta City

The mapping results in Figure 3 show that accreditation of primary health care in Yogyakarta City, based on the map, is classified into five categories. It is in the Main (Ngampilan, Gedongtengen, Kraton, Wirobrajan, and Mantrijeron) and Plenary (Tegalrejo, Jetis, Danurejan I, Danurejan II, Gondomanan, and

Mergangsan) categories with the same number of five sub-districts. Meanwhile, the Intermediate (Pakualaman) and Plenary-Madya (Gondokusuman) categories are in one sub-district area.

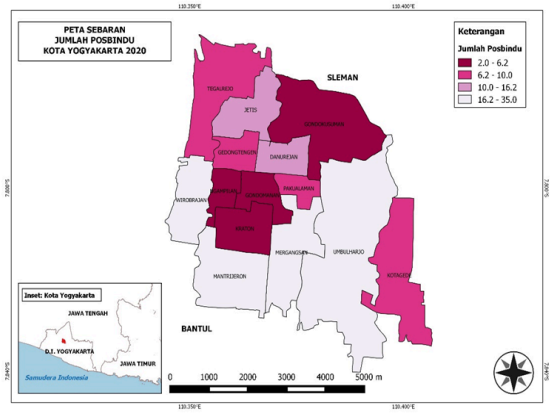

Figure 4. Map of the distribution of the number of posbindu Yogyakarta City

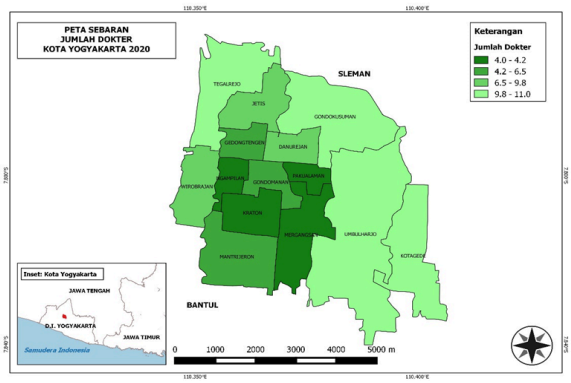

Figure 5. Map of the distribution of the number of doctors in Yogyakarta City

Figure 4 shows the distribution of the number of Posbindu in Yogyakarta city. The highest number of Non-Communicable Disease Posbindu in Yogyakarta City is in the Wirobrajan, Mantrijeron, Mergangsan, and Umbulharjo sub-districts, with around 16-35 posbindu. The lowest number of PTM Posbindu, with around 2-6, is in 4 districts with five primary health care, Gondokusuman (Gondokusuman I and II), Kraton, Gondomanan, and Ngampilan.

In Figure 5, the number of doctors in Yogyakarta City in each sub-district is obtained from the number of doctors in each puskesmas. The highest number of doctors are in Kotagede, Umbulharjo, Gondokusuman, and Tegalrejo sub-districts with 7 Primary health care (Kotagede I and II Health Centers, Umbulharjo I and II Health Centers, Gondokusuman I and II Health Centers, Tegalrejo Health Centers). The lowest number of doctors is in the Ngampilan, Kraton, Mergangsan, and Pakualaman sub-districts, with one primary healthcare provider.

Based on Figure 6, the map shows that the average number of midwives is 2-4 in the Wirobrajan, Ngampilan, Gondomanan, Pakualaman, and Mergangsan sub-districts, with one primary health care in each sub-district. Most midwives aged 8-17 are in the Jetis and Tegalrejo Districts.

The map of Figure 7 shows 3-4 nurses in the central and western regions of Yogyakarta City, the districts of Pakualaman, Gondomanan, Mergangsan, Gedongtengen, Ngampilan, Kraton, and Wirobrajan. The areas with 7-11 nurses are in the Southeast and Northwest regions of Yogyakarta City, the Kotagede, Umbulharjo, Jetis, and Tegalrejo sub-districts.

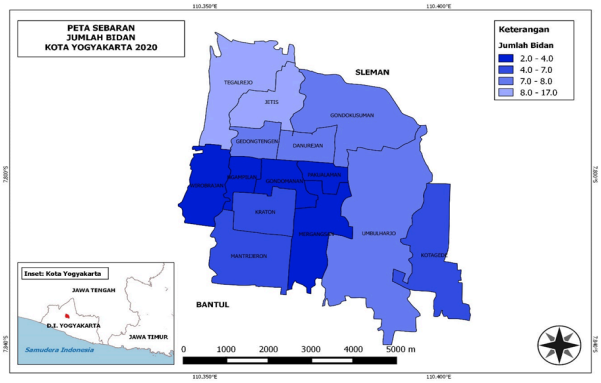

Figure 6. Map of the distribution of the number of midwives in Yogyakarta City

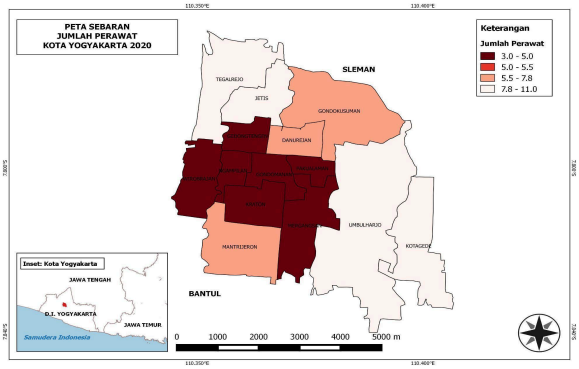

Figure 7. Map of the distribution of the number of nurses in Yogyakarta City

Based on Figure 8, the highest number of medical technicians in Yogyakarta City is 6-10 people. The areas with the highest number of medical technicians are east of Yogyakarta City, Danurejan, Gondokusuman, Umbulharjo, and Kotagede. The number of medical technicians is at least 3-4 people in the central and West of Yogyakarta City, Pakualaman, Mergangsan, Gondomanan, Gedongtengen, Ngampilan, Kraton, and Wirobrajan Districts.

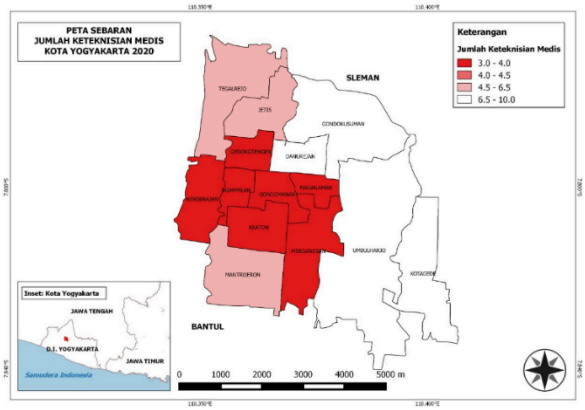

Figure 8. Map of the distribution of the number of medical technicians in Yogyakarta City

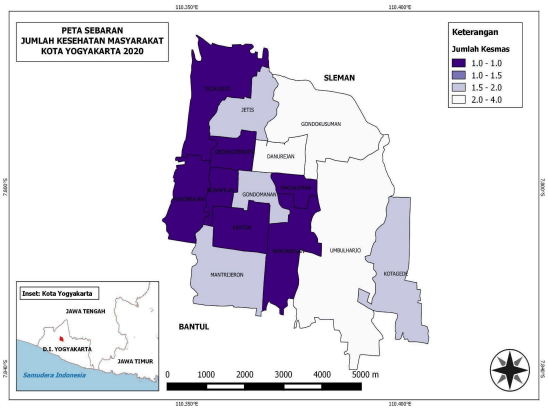

Figure 9. Map of the distribution of public health in Yogyakarta City

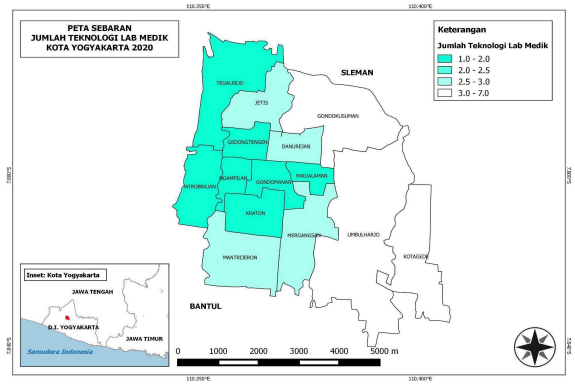

Figure 10. Map of the distribution of the number of medical laboratory technologies in Yogyakarta City

The results of this map based on Figure 9 show that the west side of Yogyakarta City has the highest number of public health workers, the Gondokusuman, Danurejan, and Umbulharjo sub-districts, which have as many as 2 to 4 people. Areas with a total of 1 person of public health workers include Tegalrejo, Wirobrajan, Gedongtengen, Ngampilan, Kraton, Pakualaman, and Mergangsan sub-districts.

Figure 10 shows the distribution of the number of medical laboratory technology. Medical laboratory technology personnel range from 3 to 7 people at most and are found in Gondokusuman, Umbulharjo, and Kotagede Districts. The number of medical lab technologies is grading downward toward the Northwest. Districts with 1 medical lab technology are Tegalrejo, Wirobrajan, Gedongtengen, Ngampilan, Gondomanan, Kraton, and Pakualaman.

DISCUSSION

When we compare the results of the number of cases and the percentage of diabetes mellitus cases, it can be said to have quite different results. In areas with a high number of cases, the area is lower when viewed from the percentage. The absolute number of cases in each sub-district determines the mitigation program in each sub-district. At the same time, the percentage figure is used when comparing various regions in an observation [12]. It is essential to know the percentage of one of them to describe the increase in the number of people affected by this disease so that it can describe the overall burden of this disease. The increasing trend of non-communicable diseases (diabetes mellitus) is followed by a shift in disease patterns. If in the past, this type of disease was usually experienced by the elderly, now it is starting to threaten the productive age group. One of the causes of D.M. is the consumption of unhealthy products, such as ready-to-eat foods that contain lots of calories and sugar.

To improve the services of First Level Health Facilities (FKTP), especially primary health care, efforts are made to improve quality and performance. One of these is conducting standard assessments through accreditation mechanisms [6]. The higher the accreditation status, the more excellent the opportunity to provide better service quality [13].

Various results were obtained from the accreditation distribution map. The accreditation of plenary primary health care located in 5 sub-districts (Tegalrejo, Jetis, Danurejan, Gondomanan, and Mergangsan) indicates the achievement of the expected value of all chapters ≥ 80% of the quality of health services at the puskesmas is said to be good, including in carrying out non-communicable disease control programs, one of which is diabetes [1].

However, based on the number of diabetes cases distributed, the Tegalrejo sub-district area with plenary accreditation still has a very high number of diabetes cases. Another point of view from the percentage of diabetes cases in the very high category is in 2 districts with plenary accreditation status, Danurejan and Jetis. This is possible because there are factors other than

accreditation in efforts to control Diabetes cases. One of the control efforts for diabetes cases is the PROLANIS program [5].

It is hoped that the community will participate in this program through the Non-Communicable Disease posbindu. The total number of NCD posbindu in Yogyakarta City is 181, a low number compared to 4 other regencies/cities in Yogyakarta Province [6]. In the study results, researchers only obtained the number of non-communicable diseases posbindu but did not know how many were active in each sub-district area. The highest number of posbindu is in the Wirobrajan area, in line with the number of diabetes cases and the percentage of diabetes cases in the low category. According to the Health Believe Model theory, individuals will likely control the disease by visiting the NCD post depending on the health assessment results and the perceived advantages and disadvantages [14]. In areas with the highest percentage of cases, it is hoped that the number of posbindu for non-communicable diseases will be increased, and monitoring and evaluation of these posbindu will be held to ensure that each posbindu is active. One of the goals of non-communicable disease posbindu is to increase community participation in the prevention and early discovery of NCD risk factors.

Medical personnel have an essential role in efforts to control diabetes cases. One plays a role in early case discovery, medical consultation, participant education, home visits, and health status monitoring. Medical personnel here include doctors, midwives, and nurses. Following the Regulation of the Minister of Health of the Republic of Indonesia Number 75 of 2014, the standard for non-inpatient health workers in urban areas for doctors is at least one person, midwives four people, and nurses five people. Judging from the number of doctors spread in each sub-district, it has met the ministry's standards with at least four people in the Pakualaman, Kraton, Mergangsan, and Ngampilan areas. At the same time, there are less than 5 nurses in Ngampilan and Kraton Districts.

Even in the primary health care of Yogyakarta, there are only 2 midwives or 3 people in the Pakualaman and Ngampilan Districts. This needs to meet the standards for the number of health workers per the Ministry of Health regulations. When viewed from the number of diabetes cases, the Pakualaman region has a low number of cases. However, the number of midwives still needs to be improved, and the number of doctors and nurses is sufficient. Inversely proportional when viewed from the percentage of diabetes cases for the Ngampilan sub-district is in the very high category. This is possible because there is still no fulfillment of midwives who are not proportional to the population.

Medical and public health technicians are part health workers based on Article 2 of Government Regulation of the Republic of Indonesia Number 32 of 1996 concerning Health workers [15]. Based on the mapping results, the most significant number of these two types of health workers is in Yogyakarta City, which has the highest area and density [16]. This may be because only some health workers can open independent services, so they work in an agency. In this data, the number of health workers is an employee of government agencies. Medical laboratory technologists are one type of health worker who has the competence to analyze human body fluids and tissues to produce information about individual and community health. The number of medical laboratory technologies in Yogya City is the highest in Umbulharjo, Gondokusuman, and Kotagede. This may be related to the area and population density in the three sub-districts. The three sub-districts are the largest and most populous areas in Yogyakarta City [16].

CONCLUSION

The distribution of diabetes cases is based on the number of cases with very high categories in the sub-districts of Umbulharjo, Gondokusuman, and Tegalrejo. In contrast, the percentage of very high category cases is in Pakualaman, Danurejan, and Jetis. This is possible due to differences in area and population. As for diabetes management programs, each region has different categories. However, Pakualaman sub-district has a very high percentage of diabetes cases accompanied by intermediate accreditation status, the number of posbindu is not too much at 6-8, the number of nurses is less than 5, the number of health cases and the number of medical laboratory technology is only one.

REFERENCES

1. Kemenkes RI. Profil Kesehatan Indonesia. 2021. Kementerian Kesehatan Republik Indonesia. Available from : [Website]
2. Kementerian Kesehatan RI. Infodatin tetap produktif, cegah, dan atasi Diabetes Melitus 2020. Pusat Data dan Informasi Kementerian Kesehatan RI. 2020. p. 1–10.
3. Pahlevi R. Proyeksi Jumlah Penderita Diabetes di Indonesia. 2021. Available from: [Website]
4. Kementerian Kesehatan RI. Laporan Riskesdas Nasional. Kementeri Kesehat RI [Internet]. 2019;1(1):1. Available from: [Website]

5. Alkaff FF, Illavi F, Salamah S, et al. The Impact of the Indonesian Chronic Disease Management Program (PROLANIS) on Metabolic Control and Renal Function of Type 2 Diabetes Mellitus Patients in Primary Care Setting. Journal of Primary Care & Community Health. 2021;12.
6. Dinkes Kota Yogyakarta. Profil Kesehatan Kota Yogyakarta Tahun 2021. Yogyakarta. 2020;107:107–26.
7. Heryana A. Diabetes Melitus : Kebijakan dan Program Pelayanan. 2019;1–8.
8. Sulistyowati L. Kebijakan Pengendalian DM di Indonesia. Simp WDD. 2017;121–30.
9. Salam S, Wahyono TYM. Pengaruh jarak ke fasilitas pelayanan kesehatan terhadap kejadian default pada penderita TB Paru di RSUD Goeteng Taroenadibrata Purbalingga. Media Publikasi Promosi Kesehatan Indonesia. 2020;3(3):197–203.
10. Aqli W, Jurusan D, Ft A. Analisa buffer dalam sistem informasi geografis untuk perencanaan ruang kawasan. Inersia. 2010;6(2):192–201.
11. Rizal S, Syaibana PLD. Analisis keterjangkauan dan pola persebaran SMA/MA Negeri di Kabupaten Banyuwangi menggunakan analisis buffering dan nearest neighbor pada aplikasi Q-GIS. TechnoCom. 2022;21(2):355–63.
12. Hutasoit I. Pengantar Ilmu Kependudukan. Alfabeta. 2017. p. 194. Available from: [Website]
13. Mawarni D, Puspitasari ST, Merillarossa I, Wardani K. Gambaran Akreditasi Puskesmas Indonesia Berdasarkan Riset Fasilitas Kesehatan 2019. IKESMA. 2022;18(1).
14. Rahmi L, Darma IY, Zaimy S. Faktor-faktor yang berhubungan dengan Pemanfaatan Buku KIA. Jurnal Ilmu Kesehatan. 2018;2(1):68–74.
15. Depkes. Peraturan Pemerintah Republik Indonesia Nomor 32 Tahun 1996 Tentang Tenaga Kesehatan. Peratur Pemerintah Republik Indonesia. 1996;1–22. Available from: [Website]
16. Badan Pusat Statistik. Kota Yogyakarta Dalam Angka 2021. BPS Kota Yogyakarta. 2021;1–446. Available from: [Website]