Determinant Factors of Length of Stays in Hospital for Diabetes Mellitus Patients

Nauri Anggita Temesvari[1]*, Pujiyanto[2], Witri Zuama Qomarania[3], Mieke Nurmalasari[4]

[1]Universitas Indonesia, nauri.anggita21@ui.ac.id* (corresponding author)
[2]Universitas Indonesia, puji_fkm@ui.ac.id
[3]Universitas Esa Unggul, witri.azuama@esaunggul.ac.id
[4]Universitas Esa Unggul, mieke@esaunggul.ac.id

Abstract

The prevalence of diabetes mellitus is increasing every year. The length of stay is one indicator of the effectiveness of the treatment carried out by the hospital. The length of stay is related to several factors, including age, comorbidities, and severity. This study presents the correlation between age, comorbidities, and severity with the length of stay in diabetes mellitus patients at Budhi Asih Regional Hospital. The study design used a cross-sectional with data sources from inpatient claims data for National Health Insurance patients from January to December 2021 at Budhi Asih Regional Hospital. The number of samples is 136 patients. The Spearman correlation test was used to see the correlation between age and secondary diagnosis with length of stay. The Kruskal-Wallis H test was used to see the relationship between severity and length of stay. Majority of patients were female (59.6%). Median at age 56.5 years, comorbid 2, and length of stay seven days. As many as 61.8% of patients were at moderate severity, 93.4% were discharged with the doctor's approval, and 67.6% had type 1 diabetes mellitus. There was no correlation between age and length of stay (p-value 0.636 and ρ 0.041). There is a correlation between comorbidities (p-value 0.000 and ρ 0.533) and severity (p-value 0.000) with length of stay. This study shows a relationship between comorbidities and severity with length of stay. In comparison, age is not associated with length of stay.

Keywords:
Diabetes mellitus; length of stay; Budhi Asih Regional Hospital

Correspondence Address:
Kramat Jati, East Jakarta , Indonesia
E-mail:
nauri.anggita21@ui.ac.id

Introduction

Diabetes mellitus is a chronic disease that occurs when the pancreas does not produce enough insulin, or when the body cannot effectively use the insulin it produces. Increased blood sugar is a common effect of uncontrolled diabetes causing damage to the body's systems (Mahmud et al., 2018). Diabetes mellitus has become a global health problem because the number of cases increases every year. According to the International Diabetes Federation (IDF) in 2021 in Indonesia there are 19.5 million people with diabetes mellitus and it is predicted to increase to 28.6 million in 2045 (International Diabetes Federation, 2021). The results of national basic health research in 2018 showed that DKI Jakarta Province was the province with the highest prevalence of diabetes mellitus (3.4%) in Indonesia (Kementerian Kesehatan, 2018).

In general, diabetes mellitus is divided into type 1 and type 2 (T1D and T2D) (Arneth et al., 2019). Type 1 diabetes mellitus is a condition where insulin stops producing due to damage to pancreatic cells. This type of diabetes is usually diagnosed in children or young adults. Children with type 1 DM not only face short-term complications such as hypoglycemia and diabetic ketoacidosis (DKA), both of which have significant risks of morbidity and mortality, but also long-term complications in the form of macrovascular and microvascular changes (Adelita et al., 2020). Studies show the incidence of this type of diabetes is 15 per 100,000 population and the prevalence is 9.5% (95% CI 0.07-0.12) (Mobasseri et al., 2020).

Type 2 diabetes mellitus is also called non-insulin dependent where insulin works less effectively (Milita et al., 2021). In 2017, around 462 million people were diagnosed with type 2 diabetes mellitus which is equivalent to 6.28% of the world's population (4.4% aged 15-49 years, 15% aged 50-69, and 22% aged >69 years) with an incidence of 6,059 cases per 100,000 world population (Khan et al., 2020). Complications that occur include cardiovascular system disorders such as atherosclerosis, retinopathy, impaired kidney function, and nerve damage (Milita et al., 2021).

Length of stay (LOS) is an indicator of medical services provided by the hospital to patients. LOS can show how long a patient is hospitalized with one treatment period (Alfiani et al., 2021). LOS is an indicator in patient care, in which the less LOS results in a change in the degree of health the better for the patient indicating effective treatment (Khairi Lubis, 2017). If it is related to costs, then reducing the length of stay, the patient and family can reduce the burden of inpatient costs (Nirmalasari et al., 2020). Differences in age (D'Agostino et al., 2019), severity of disease, and the presence of comorbidities (Dimitri et al., 2018; Ghosh et al., 2021; Toptas et al., 2018) have a relationship with length of stay. The aim of this study was to analyze the relationship between age, comorbidities and severity with length of stay.

Methods

The design of this research is cross sectional. The sample is all data on inpatient claims from National Health Insurance (JKN) patients with a primary diagnosis of diabetes mellitus (ICD-10 E10-E14) from January to December 2021 at one of the type B government hospitals in East Jakarta. This research has been carried out an ethical review at the Research Center of the hospital where this research was conducted with the issuance of a letter passing the ethical review 418/KEP-ETIK/XI/2022 dated 14 November 2022. Meanwhile, the samples were taken from patients whose discharge status was deceased and who experienced readmission within a period of time. 30 (thirty) days are excluded as a sample. So the total sample was obtained, namely 136 cases.

The age variable is the difference between the patient's date of birth and the date the patient was treated. The patient's length of stay variable is the difference between the date of discharge and the date of admission of the patient to the hospital. Meanwhile, comorbid variables were measured by the number of comorbidities in the patient. The severity variable refers to the INA CBG guidelines for category 1 mild severity, category 2 moderate severity, and category 3 severe severity.

To describe each variable in numerical data, center size is used, while in categorical data, frequency distribution is used. In testing the hypothesis to see the relationship between age, comorbidities, severity and length of stay using several statistical tests. To examine the relationship between age and comorbidities with length of stay using Spearman correlation. Meanwhile, the Kruskal-Wallis H test was used to test the relationship between severity level and length of stay. An illustration of the distribution of length of stay at each level of severity is presented using a boxplot.

Results
Patient Characteristics

The characteristics of all patients in the study (n = 136) are shown in Tables 1 and 2. Most of the patients were female, 81 patients (59.6%) with a patient age range of 11-82 years (mean = 55.84, median = 56,5). The length of patient stay ranged from 1 to 22 days (mean = 7.72, median = 7) and the number of patient comorbidities ranged from none to eight comorbids (mean = 7.72, median = 2). The majority of patients were treated with moderate severity in 84 patients (61.8) and discharge status with doctor's approval in 127 patients (93.4%). Most patients were treated with a primary diagnosis of Type 1 Diabetes Mellitus with a total of 92 patients (67.6%).

Table 1.
Patient Characteristics based on Gender, Severity, Discharge Status, Type of Diabetes Mellitus (n=136)

Variable	n	%
Gender		
Male	55	40,4
Female	81	59,6
Severity illness		
Mild	21	15,4
Moderate	84	61,8
Severe	31	22,8
Discharge status		
Doctor's approval	127	93,4
Referred	1	0,7
At own request	7	5,1
Others	1	0,7
Type of diabetes mellitus		
Type 1 diabetes mellitus	92	67,6
Type 2 diabetes mellitus	36	26,5
Unspecified diabetes mellitus with ketoacidosis	8	5,9

Table 2.
Patient Characteristics based on Age, Length of Stay, and Comorbidities

Variable	Min-Max	Mean	Median	SD
Age (Years)	11-82	55,84	56,5	13,1
Length of stay	1-22	7,72	7	3,9
Comorbidities	0-8	2,68	2	1,60

Correlation between Age, Comorbidity, and Severity with Length of Stay for Diabetes Mellitus Patients

Before testing the hypothesis in this study, a normality test was carried out on the length of stay variable. The normality test results show that the p-value is 0.000, which means the data is not normally distributed. Table 3. presents the relationship between age and comorbidities with length of stay in patients with diabetes mellitus. There is no relationship between age and length of stay (p-value 0.636). There is a relationship between comorbidities and length of stay (p-value 0.000) and the correlation value is positive with a very strong relationship (ρ 0.533).

Table 3.
Correlation between Age and Comorbidities with Length of Days of Care for Diabetes Mellitus Patients

Variable	ρ	p-value
Usia	0,041	0,636
Komorbid	0,533	0,000

Table 4. describes the relationship between severity and length of stay in patients with diabetes mellitus. From the results of the Kruskal-Wallis H test, it appears that there is a difference in the average length of stay based on the severity of diabetes mellitus patients (p-value 0.000). Based on Figure 1, the trend of length of stay increases with increasing severity. At mild severity, the average length of stay is 3 days. At moderate severity, the average length of stay is 7 days, with 3 (three) respondents having a length of stay of more than 15 days. At the severity level, the average length of stay was 8 days, with 2 (two) respondents having a length of stay of more than 21 days.

Table 4.
Mean Different Test Based on Severity Level of Diabetes Mellitus Patients

Variable	p-value
Severity illness	0,000

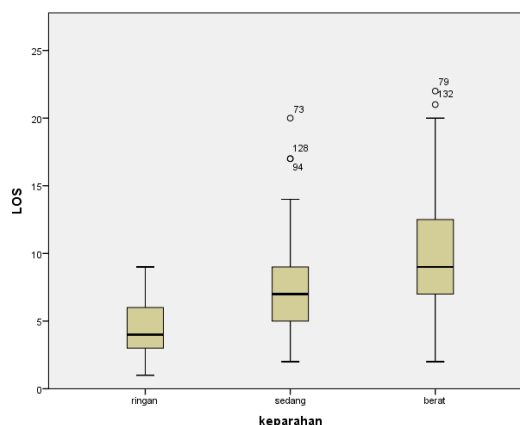**Figure 1.** Boxplot Distribution of Length of Stay based on Severity Level of Diabetes Mellitus Patients

Discussion

Age had no relationship with length of stay in this study. These results are different from findings in other studies which state that age has an effect on length of stay, where differences in length of stay occur more in the elderly (D'Agostino et al., 2019).

In this study, the presence of comorbidities was related to the length of stay. This is in line with research by Toptas, et al which concluded that there was an increase in length of stay in diabetes mellitus patients who had complications (p-value 0.0004) (Toptas et al., 2018). Likewise, in research by Olthof, et al, several comorbidities in diabetes mellitus patients can result in complications that require longer treatment (Olthof et al., 2014). Complications of diabetes mellitus are classified into acute and chronic complications. Acute complications are short-term complications due to glucose imbalance such as hypoglycemia, diabetic ketoacidosis (DKA), hyperglycemic hyperosmolar non-ketotic syndrome (NHNK). Chronic complications generally occur after 10 to 15 years including macrovascular complications, microvascular complications and foot neuropathy (Valent et al., 2017). Diabetes mellitus patients often also have other comorbidities such as hypertension, obesity and tuberculosis (Cannon et al., 2018; Ekoru et al., 2019).

The severity of disease in INA CBG is related to the number of comorbidities/complications in the patient (Cannon et al., 2018). The level of severity and length of stay in this study were related. This study is in line with previous research that there is a difference in the length of stay in the severity of the disease (p-value 0.000) (Setareh et al., 2021). The higher the severity, the more intensive care is needed which requires a longer length of stay than the usual severity (Oktadiana, 2021).

The length of stay is a reflection of the efficiency of health services and is an important indicator for measuring the quality of health services. By reducing the length of stay, cost efficiency will be achieved because the costs of accommodation and inpatient treatment will be reduced. Therefore, efforts that can be made to reduce the length of stay are through the implementation of clinical pathways so that patients get services according to their needs.

Clinical pathways combine medical care protocols, nursing care plans, and related health care professional activities into a single plan of care, which clearly defines the progress and outcomes expected of patients through the hospital system. This clinical pathway begins either at patient admission or the start of the procedure and ends at discharge (Firmansyah & Widjaja, 2022). Medical and nursing personnel will provide a therapy plan that the patient must carry out when they go home. Insulin therapy and diet are therapies commonly used by diabetes mellitus patients. However, some patients during post-hospital treatment do not comply with the therapy plan given (Fitriani et al., 2019). Consistency in treating diabetes mellitus patients after discharge from the hospital can control the course of the disease and complications in patients so that patients do not experience readmission due to recurrence (Silvina Marbun et al., 2022).

The limitation of this study is that it only collects data on JKN patients, does not differentiate between patients with other types of financing. In addition, data on JKN claims cannot differentiate between comorbidities and complications.

Conclussion

This study shows that there is a relationship between comorbidities and severity with length of stay in patients with diabetes mellitus. In this study, there was no relationship between age and length of stay. Standardized care refers to clinical pathways that can reduce length of stay. However, consistent care after discharge from the hospital is also important so that diabetes mellitus patients do not experience a recurrence which results in a readmission in a worse condition than the previous admission.

Author Contributions

Conceptualization, writing proposal, project administration, and reporting N.A.T; methodology, and collecting data W.Z.Q and M.N; analyzing and interpretation M.N, W.Z.Q, and N.AT; review and editing, P.P. All authors have read and agreed to the published version of the manuscript.

Funding

This research received funding by Universitas Esa Unggul.

Institutional Review Board Statement

This research has been carried out an ethical review at the Research Center of the hospital at Budhi Asih Hospital where this research was conducted with the issuance of a letter passing the ethical review 418/KEP-ETIK/XI/2022 dated 14 November 2022.

Conflicts of Interest:

The authors declare no conflict of interest.

References

Adelita, M., Arto, K. S., & Deliana, M. (2020). Kontrol Metabolik pada Diabetes Melitus Tipe-1. *Cermin Dunia Kedokteran*, *47*(3), 227–232. https://garuda.kemdikbud.go.id/documents/detail/2888232

Alfiani, D. N., Yani, A., & Hermanto, R. A. (2021). Gambaran Lama Hari Rawat Inap, Perubahan Kadar Glukosa Darah, Asupan Energi Dan Karbohidrat Pada Pasien Diabetes Mellitus Tipe II Rawat Inap dI RSU Holistic Purwakarta. *Journal of Holistic and Health Sciences*, *5*(1), 9–13.

Arneth, B., Arneth, R., & Shams, M. (2019). Metabolomics of type 1 and type 2 diabetes. In *International Journal of Molecular Sciences* (Vol. 20, Issue 10). MDPI AG. https://doi.org/10.3390/ijms20102467

Cannon, A., Handelsman, Y., Heile, M., & Shannon, M. (2018). Percentage with diabetes Number with diabetes. *Journal of Managed Care & Specialty Pharmacy*, *24*(9). www.jmcp.org

D'Agostino, F., Vellone, E., Cocchieri, A., Welton, J., Maurici, M., Polistena, B., Spandonaro, F., Zega, M., Alvaro, R., & Sanson, G. (2019). Nursing Diagnoses as Predictors of Hospital Length of Stay: A Prospective Observational Study. *Journal of Nursing Scholarship*, *51*(1), 96–105. https://doi.org/10.1111/jnu.12444

Dimitri, G., Giacco, D., Bauer, M., Bird, V. J., Greenberg, L., Lasalvia, A., Lorant, V., Moskalewicz, J., Nicaise, P., Pfennig, A., Ruggeri, M., Welbel, M., & Priebe, S. (2018). Predictors of length of stay in psychiatric inpatient units: Does their effect vary across countries? *European Psychiatry*, *48*, 6–12. https://doi.org/10.1016/j.eurpsy.2017.11.001

Ekoru, K., Doumatey, A., Bentley, A. R., Chen, G., Zhou, J., Shriner, D., Fasanmade, O., Okafor, G., Eghan, B., Agyenim-Boateng, K., Adeleye, J., Balogun, W., Amoah, A., Acheampong, J., Johnson, T., Oli, J., Adebamowo, C., Collins, F., Dunston, G., … Rotimi, C. (2019). Type 2 diabetes complications and comorbidity in Sub-Saharan Africans. *EClinicalMedicine*, *16*, 30–41. https://doi.org/10.1016/j.eclinm.2019.09.001

Firmansyah, Y., & Widjaja, G. (2022). PEMBERLAKUAN CLINICAL PATHWAY DALAM PEMBERIAN LAYANAN KESEHATAN DAN AKIBAT HUKUMNYA. *Cross-Border*, *5*(1), 536–573.

Fitriani, Y., Pristianty, L., Hermansyah, A., Kesehatan Provinsi Jawa Timur, D., & Ahmad Yani, J. (2019). Pendekatan Health Belief Model (HBM) untuk Menganalisis Kepatuhan Pasien Diabetes Melitus Tipe 2 dalam Menggunakan Insulin. *Pharmaceutical Journal of Indonesia*, *16*(02), 167–177.

Ghosh, A. K., Unruh, M. A., Soroka, O., & Shapiro, M. (2021). Trends in medical and surgical admission length of stay by race/ethnicity and socioeconomic status: a time series analysis. *MedRxiv*. https://doi.org/10.1101/2021.05.27.21257925

International Diabetes Federation. (2021). *Diabetes around the world in 2021*. https://diabetesatlas.org/regional-factsheets/

Kementerian Kesehatan. (2018). *RISKESDAS 2018*.

Khairi Lubis, I. (2017). *Analisis Length Of Stay (Los) Berdasarkan Faktor Prediktor Pada Pasien DM Tipe II di RS PKU Muhammadiyah Yogyakarta* (Vol. 2, Issue 2).

Khan, M. A. B., Hashim, M. J., King, J. K., Govender, R. D., Mustafa, H., & Kaabi, J. Al. (2020). Epidemiology of Type 2 diabetes - Global burden of disease and forecasted trends. *Journal of Epidemiology and Global Health*, *10*(1), 107–111. https://doi.org/10.2991/JEGH.K.191028.001

Mahmud, F. R., Sudirman, S., & Afni, N. (2018). Faktor-Faktor Yang Berhubungan Dengan Penyakit Diabetes Melitus Di Ruang Poli Interna Rsud Mokopido Kabupaten Tolitoli. *Jurnal Kolaboratif Sains*, *1*(1), 168–175.

Milita, F., Handayani, S., & Setiaji, B. (2021). Kejadian Diabetes Mellitus Tipe II pada Lanjut Usia di Indonesia (Analisis Riskesdas 2018). *Jurnal Kedokteran Dan Kesehatan*, *17*(1), 9–20. https://jurnal.umj.ac.id/index.php/JKK

Mobasseri, M., Shirmohammadi, M., Amiri, T., Vahed, N., Fard, H. H., & Ghojazadeh, M. (2020). Prevalence and incidence of type 1 diabetes in the world: A systematic review and meta-analysis. In *Health Promotion Perspectives* (Vol. 10, Issue 2, pp. 98–115). Tabriz University of Medical Sciences. https://doi.org/10.34172/hpp.2020.18

Nirmalasari, N., Nofiyanto, M., & Hidayati, R. W. (2020). Lama Hari Rawat Pasien Stroke. *Jurnal Terpadu Ilmu Kesehatan*, *9*(2), 117–268. https://jurnalinterest.com/index.php/int/article/view/196/157

Oktadiana. (2021). Perbandingan Biaya Riil Pada Pasien Diabetes Mellitus Tipe 2 Dengan Tarif INA-CBG'S Di Rumah Sakit Umum Daerah. *Jurnal Farmasi Tinctura*, *2*(2), 42–51.

Olthof, M., Stevens, M., Bulstra, S. K., & Van den Akker-Scheek, I. (2014). The association between comorbidity and length of hospital stay and costs in total hip arthroplasty patients: A systematic review. In *Journal of Arthroplasty* (Vol. 29, Issue 5, pp. 1009–1014). Churchill Livingstone Inc. https://doi.org/10.1016/j.arth.2013.10.008

Setareh, M., Alavi, N., & Atoof, F. (2021). Severity of illness affecting the length of stay and outcomes in patients admitted to intensive care units, Iran, 2019. *Journal of Education and Health Promotion*, *10*(1). https://doi.org/10.4103/jehp.jehp_780_20

Silvina Marbun, A., Brahmana, N., Parida Sipayung Ceria Sinaga, N., Lina Uli Marbun, K., & Halianja Prodi, R. S. (2022). Pelaksanaan Empat Pilar pada Penderita Diabetes Melitus. *Jurnal Abdimas Mutiara*, *3*(1), 366–371.

Toptas, M., Samanci, N. S., Akkoc, E., Yucetas, E., Cebeci, E., Sen, O., Can, M. M., & Ozturk, S. (2018). Factors affecting the length of stay in the intensive care unit: Our clinical experience. *BioMed Research International*, *2018*. https://doi.org/10.1155/2018/9438046

Valent, F., Tonutti, L., & Grimaldi, F. (2017). Does diabetes mellitus comorbidity affect in-hospital mortality and length of stay? Analysis of administrative data in an Italian Academic Hospital. *Acta Diabetologica*, *54*(12), 1081–1090. https://doi.org/10.1007/s00592-017-1050-6