Original Article

Relationship Between Complications and Readmissions in Type 2 Diabetes Mellitus Patients in Aceh, Indonesia

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Abstract

Introduction

Readmission refers to a condition where a person is readmitted five days after hospitalization[1.] Readmission is defined as an unplanned inpatient admission back to the hospital within 30 days from the previous discharge, unless the previous one apparently required readmission.Hospital readmission is when a patient who has been discharged is treated again, either in the same or a different hospital, within a certain period of time. Readmission periods commonly used for research include 30 days, 90 days, and 1 year. Approximately 30% of hospitalized diabetes mellitus patients experience two or more readmissions the following year and contribute to one of the 10 causes of readmissions worldwide[2.]

Readmission has a negative impact in many ways. A hospital readmission constitutes an indicator of service quality and represents the inadequacy of the health service system[3]. It is seen as highly irritating to health services. In Poland, the readmission rate is 19.2% and found in one in five hospitals. Readmissions oftentimes occur due to a lack of continuity of care between in-hospital- and post-hospital care. During hospitalization, patients often receive new medications, changes in therapeutic regimens, and lack effective guidance. Besides, readmission will affect changes in family functions and duties regarding patient care. It consequently requires family members to adjust to the readmission conditions the patient must undergo[1.]

Hospitals are pursuing various methods to prevent patient readmissions. A crucial action include improving coordination and communication between care providers, including nurses and educators. Nurses are responsible for providing intervention and education in preparation for the patient's discharge[1].

One illness that contributes to many patients experiencing readmissions is diabetes mellitus

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(DM). DM is a group of metabolic diseases characterized by increased levels of glucose in the blood (hyperglycemia) resulting from defects in insulin secretion, insulin action, or both[1]. Type 2 diabetes mellitus, previously known as NonInsulin Dependent Diabetes Mellitus(NIDDM)covers 90–95% of all diabetes mellituscases. This particular type is believed to begin from insulin resistance, causing the interaction between insulin and glucose to be less efficient which leads to abnormal insulinmetabolism[4]. Diabetes mellitus may lead to blood circulation problems, such as macrovascular and microvascular issues and need roles of health care providers to handle it[5].

From the perspective of the implementation of nursing care, every hospitalized DM patient should have received proper preparation for discharge planning. The preparation provided as nursing interventions to patients includes education on how to perfom home care, take medication, and self-inject insulin. However, the number of hospital readmissions cases remains high. The results of a systematic review on 2,528 articles encompassing a total of 1417 patients demonstrate that educational nursing interventions are correlated with patient readmissions[6].

When diabetes mellitus is not properly treated, it may cause various complications, both microvascular and macrovascular. Results of a study using a systematic review on 13.283 Type 2 DM patients aged over 20 years, originating from Asia, Africa, Oceania, South America, and the Caribbean, show that microvascular complications of DM include retinopathy, nephropathy, and neuropathy; while macrovascular ones include ischemic heart disease, peripheral arterial disease, and stroke. This aligns with a study using a retrospective cohort on 135,199 type 2 DM patients with a mean age of 58 years in California, discovering that. The most major DM complications include peripheral neuropathy, chronic kidney disease (CKD), and cardiovascular disease (CVD).

Uncontrolled DM cases can trigger serious complications for the heart, kidneys and eyes[3], resulting in blindness, kidney failure, heart failure, stroke, neurological disease, amputation and impotence[7]. Frequent health problems or complications experienced by patients with type 2 diabetes mellitus surround urinary incontinence, weight loss, weakness, hypoglycemia, peripheral neuropathy, peripheral vascular disease, diabetic retinopathy, hypertension, arthritis and Parkinson's disease[3,8].

Chronic hyperglycemia affecting people with DM causes damage to various organs and body systems as well as triggers different complications which may harm their quality of life. A number of studies have indicated hyperglycemia is correlated with mortality and morbidity in hospitalized patients[7]. A variety of worsening conditions and complications oftentimes have DM patients end up with readmission[9].

Interestingly, in Aceh,a studyon 1,364 individuals with diabetes mellitus who have undergone treatments at the provincial hospital polyclinic in Banda Acehshow different findings. It is revealed that there is no relationship of patient age and previous nurses with the ability to detect hyperglycemia among diabetes mellitus patients. Especially in Lhokseumawe and North Aceh, research to identify factors linked to readmission in diabetes mellitus patients has never been conducted[10].

According to the data obtained from the Cut Meutia Public Hospital, North Aceh Regency, which is the main referral hospital in the Lhokseumawe and North Aceh City areas, of the 989 type 2 diabetes mellitus patients hospitalized in 2023, 286 (28.9%) experienced readmissions. Interviews with 15 re-admitted patients in the internal medicine ward exhibit that 7 of them mention weakness and blood sugar levels remaining high as the complaints causing them to be re-admitted; while 6 are due to inability to control their diet; and 2 due to gangrene infected wounds that were difficult to heal.

Methods and Materials

A correlational study was utilized with a cross-sectional design. A total of 184 readmission patients with type 2 diabetes mellitus were selected as the sample using the accidental sampling technique. Data were collected through a questionnaire. The instruments consists of the Diabetes Early Readmission Risk Indicators (DERRI™) and the Readmission Questionnaire. The reliability test of the questionnaire used results in: DERRI™ with a reliability of 0.80 and validity of 0.36[11].

Data collection was undertaken via questionnaire distribution at the Cut Meutia Public Hospital, North Aceh, in several inpatient rooms including those for men's internal medicine (Shafa), women's internal medicine (Marwah), men's surgery (Arafah I), and women's surgery (Arafah II) as well as the VIP room (Muzdhalifah) from December 13th, 2023 to January 24th, 2024. The respondents were given a set of questionnaire with questions regarding diabetes mellitus complications and readmission time.

It is essential that the present research consider the recommendations of other parties, particularly in the forms of results of research ethics tests issued by the Ethics Committee of Nursing Research of the Faculty of Nursing,Universitas Syiah Kuala, with number: 112009161023; as well as permission from the agency/office where the research location took place, i.e. the Cut Meutia Public Hospital, as the researchers started conducting research after receiving the approval. All respondents were given the informed concern to be involved in this research.

Data analyses were carried out using a frequency distribution and Chi-square test.

Results

The results are presented in a table of demographic data and scores from statistical tests for each variable.

Table 1. Respondent Frequency Distribution Based on Demographic Data of Re-admitted Patients with Type 2 Diabetes Mellitus (n=184)

No	Category	f	%
1	Age (year): (Mean±SD)	57.30±10.294	
	25–37 (adult)	5	2.7
	38–49 (middle-adult)	40	21.7
	50–61 (late-adult)	70	38.0
	>61 (elderly)	69	37.5
2	Sex		
	Male	111	60.3
	Female	73	39.7
3	Education		
	None	57	31.0
	Elementary School/equivalent	99	53.8
	Junior High School/equivalent	20	10.9
	Senior High School/equivalent	7	3.8
	Higher education	1	0.5
4	Occupation		
	Unemployed	69	37.5
	Farmer/laborer/fisherman	102	55.4
	Civil servant/Army/Police officer	1	0.5
	Self-employed	12	6.5
5	Insulin Type		
	Apidra	4	2.2
	Humalog	67	36.4
	Humalog mix	10	5.4
	Humulin R	57	31.0
	Lantus	9	4.9
	Lispro	1	0.5
	Lovemir	22	12.0
	Novorapid	14	7.6

No	Category	f	%
	Readmission		
	2nd time	38	20.7
	3rd time	69	37.5
	4th time	58	31.5
	Above 4th time	19	10.3

From Table 4.1, the respondents' characteristics can firstly be seen by age groups, in which the majority are in late adulthood (50-61 years)totaling 70 individuals (38.0%) while the fewest are aged 25-37, categorized as the adult consisting of 5 (2.7%). Besides, there are 111 male respondents (60.3%). In terms of education levels, the majority of respondents are elementary school graduates, totaling 99 (53.8%). The most common occupation is farmer/laborer/ fisherman, undertaken by 102 respondents (55.4%). The type of insulin mostly used is Humalog, which is by 67 individuals (36.4%). Lastly, the highest number of readmissions is the third-time hospitalization, experienced by 69 respondents (37.5%).

Table 2. Frequency Distribution and Readmissions of Type 2 Diabetes Mellitus Patients at the Cut Meutia Public Hospital, North Aceh Regency (n=184)

No	Category	f	%
1	Complication		
	Present	105	57.1
	Absent	79	42.9
2	DM patient readmission		
	≤30 days	71	38.6
	>30–60 days	24	13.0
	>60–90 days	25	13.6
	>90 days	64	34.8

Based on Table 2, it can be seen that 105 respondents (57.1%) have disease complications. Moreover, 71 respondents (38.6%) experience readmission less that 30 days from the previous discharge.

Table 3. Relationship between Diabetes Mellitus Complications and Readmissions in Type 2 Diabetes Mellitus Patients (n = 184)

DM Complication	DM Patient Readmission										
	≤30 days		31–60 days		61–90 days		>90 days		Total		p
	n	%	n	%	n	%	n	%	n	%	
Present	59	56.2	19	18.1	21	20.0	6	5.7	105	100	0.000
Absent	12	15.2	5	6.3	4	5.1	58	73.4	79	100	
Total	71	38.6	24	13.0	25	13.6	64	34.8	184	100	

According to Table 3, it can be seen that the majority of respondents experiencing readmissions are those with complications, totaling 59 patients (56.2%), with the highest readmission interval, i.e. ≤ 30 days. Meanwhile, overall, the largest number of respondents undergoing readmissions comes from those with complications, totaling 105 (57.06%). The data analysis via the Chi-square test result in $p = 0.000 < \alpha = 0.05$, indicating that there is a relationship between diabetes mellitus complications and readmission of patients with type 2 diabetes mellitus.

Discussion

Based on the analysis and findings, it can be seen that the largest number of respondents experiencing readmissions are those who also have complications, with the highest readmission interval of ≤ 30 days, totaling 59 patients (56.2%). Meanwhile, the overall largest number of respondents who have undorgone readmissions is from those having complications, totaling 105 individuals (57.06%). The results from analysis using the Chi-square test show that $p = 0.000 < \alpha = 0.05$, meaning that there is a relationship between diabetes mellitus complications and readmission of patients with type 2 diabetes mellitus.

These findings align with previous research on acute diabetes complications as a predictor of rehospitalization and mortality associated with hospital admissions in diabetes mellitus patients. Chronic hyperglycemia in diabetes mellitus patients with poor control of blood sugar levels leads to the damage to various organs and body systems, increasing diabetes complications which eventually affect the patient's quality of life[7].

Complications are among the risk factors for hospital readmissions in patients with diabetes mellitus. Approximately 40% of rehospitalized patients have at least one diabetic microvascular complication; and approximately 50% have at least one macrovascular complication[12].

Likewise, a study discovers that comorbidities and complications become predictors of unplanned hospital readmissions in adult patients with diabetes mellitus within 30 days after discharge. Insulin resistance in diabetes patients causes hyperglycemia, triggerering atherosclerotic lesions and, therefore, becomes the major cause of cardiovascular disease[2].

In patients with type 2 diabetes mellitus, insulin production is inadequate to meet the need for glucose transport into cells. The condition ultimately results in various complications, some of which are acute, some chronic.

Although the types of diabetes mellitus complications are not specifically explored in the present research, a previous one[(15)] mentions that acute complications in patients with type 2 diabetes mellitus include diabetic ketoacidosis, diabetic coma, hypoglycemia, and hyperglycemia. Diabetic ketoacidosis is a harmful complication in which patients experience signs of dehydration, Kusmaul breathing and acetone aspiration, a gradual decrease in the level of consciousness, and (in severe cases) hypotension and circulatory shock, and ultimately diabetic coma. Hypoglycemia occurs when blood sugar levels are at an extremely low point. Hypoglycemia is a major complication in diabetes treatment, possibly caused by administering inappropriate insulin doses (high doses), excessive physical exercise, or lack of food or carbohydrate intake. Hyperglycemia occurs when blood sugar levels are very high. It is a serious and life-threatening diabetic complication. Hyperglycemia can occur due to not taking medication, insufficient dosage of medication, or excessive consumption of sweet foods without an appropriate treatment regimen, or infection. Diabetic can lead microvascular and macrovascular complications as a major cause of morbidity and mortality. Macrovascular complications include myocardial infarction, stroke, peripheral vascular disease and diabetic foot[13]. Meanwhile, chronic complications include macroangiopathy, retinopathy, nephropathy, neuropathy, diabetic foot, and increased susceptibility to infection[14].

Complications caused by type 2 diabetes mellitus increase the rate of hospitalization, death, and disability. If uncontrolled and poorly treated, type 2 diabetes mellitus will lead to serious complications, raising blood coagulation, retinopathy, hypertension, chronic kidney disease, or leg ulcers. It also significantly reduces patient productivity and life expectancy[15].

Conclusion

Several factors can contribute to the hospital readmission of patients with type 2 diabetes mellitus, including imbalances in blood sugar levels, diet, physical activity, therapy compliance, disease complications, etc. More specifically, the present research discovers that disease complications are significantly associated with hospital readmissions of type 2 diabetes mellitus patients. Also, the findings indicate 57.1% of respondents such experiencing as hypoglycemia, hypertension, heart failure, kidney failure, diabetic wounds, and ketoacidosis.

Moreover, other factors also have positive correlation with diabetic readmission. the previous study mentioned that age, duration of diabetes and hospitalization costs were positively correlated with times ofhospitalization[16].

Recommendations:

It is recommended that the hospital re-evaluate and develop strategies for nursing services and nursing interventions by providing effective discharge planning in order to prevent complications or reduce readmissions in Type 2 Diabetes Mellitus patients.

Ethical Clearance: The research approval was given by the Ethics Committee of Nursing Research (KEPK) of Faculty of Nursing, Universitas Syiah Kuala, with Number 112009161023.

Conflict of interest: The authors declare no conflicts of interest in this study.

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