The Effect of Clinical Pathway Implementation on the Length of Days of Ischemic Stroke Patient Hospitalization at Three Hospitals in Indonesia

Telly Purnamasari[1(✉)], Rizaldy T. Pinzon[2], Asri C. Adisasmita[3], Mondastri K. Sudaryo[3], Trihono Trihono[4], and Ajeng T. Endarti[5]

[1] Center Research of Preclinical and Clinical Medicine, National Research and Innovation Agency – Health Research Organization, Jakarta, Indonesia
tell001@brin.go.id
[2] Kristen Duta Wacana University, Yogyakarta, Indonesia
[3] Department of Epidemiology. Faculty of Public Health, Indonesia University, Depok, Indonesia
[4] Ministry of Health, Jakarta, Indonesia
[5] Mohammad Husni Thamrin University, Jakarta, Indonesia

Abstract. Clinical pathways (CP) regarding stroke is a medical service standard necessitated ensuring quality health services at rational costs. The previous study showed that the effect of CP implication on hospitalization length has not shown conclusive results in one hospital nor considered the CP format used. Therefore, this study aims to measure the implication of ischemic stroke CP on hospitalization length. This study was conducted in public and private hospitals, type A and B, which run a stroke registry with uniformity in stroke care and CP format. A retrospective cohort design was used to measure the effectiveness of the ischemic stroke clinical pathway on the outcome of hospitalization length by controlling for confounding variables, including demographic factors, comorbidities, clinical, service procedure, and management support. The data source for the Ischemic Stroke CP group was obtained from the document in the hospital. The data of the without CP group was obtained from the Stroke Registry of the Research and Development Agency, and the medical record was traced to obtain the required variables. The population is ischemic stroke patients treated from January 2012-December 2015. The sample was selected purposively, meeting the inclusion and exclusion criteria, and the ischemic stroke diagnosis is based on medical records with ICD-X 163.9. The cut-off point for the length of hospitalization was determined by Receiver Operating Characteristic analysis, divided into 2 categories, long (>8 days) and short (≤8 days). Univariate, bivariate, stratification and multivariate analysis were performed using the Cox regression test. The results showed that 71% of the subjects were treated without CP, 65% had a short hospitalization length (<8 days), 39% were aged 18–55, and 57% were male. In men, 88% had dyslipidemia, 77% were admitted with mild severity as measured by the Glasgow Coma Scale (GCS = 15), and 35% had attack onset of admissions >24 h. The stratification test showed no interaction between the independent (CP) and the covariate variable on hospitalization length. Multivariate analysis found that CP significantly reduced the risk of hospitalization length (>8 days) by 53%, compared to patients treated without CP, after controlling for disease severity,

I. Nurlaila et al. (Eds.): ICHR 2022, AHSR 56, pp. 580–590, 2023.
https://doi.org/10.2991/978-94-6463-112-8_53

management support, and service processes (RR: 0.47; 95%CI: 0.24–0.93; p: 0.020). The ischemic stroke CP implementation significantly reduces the risk of long hospitalization days. Implementation, monitoring, and CP evaluation should improve patient clinical outcomes. These efforts are needed to produce quality services that are part of the National Health Insurance policy objectives.

Keywords: clinical pathway · ischemic stroke · hospitalization length days

1 Introduction

Approximately 70% of strokes and 87% of deaths and disabilities occur in low- and middle-income countries [1]. Basic Health Research (Riskesdas) reports an increase in stroke from 7% in 2013 to 10.9% in 2018 [2, 3]. In 2012, there were 5,411 registered strokes in 19 hospitals in Indonesia, and it was reported that 68% were ischemic and hemorrhagic cases [4]. Stroke causes enormous clinical and financial consequences, which need to be addressed.

Quality health services at rational costs are a demand, especially in the era of National Health Insurance. More organized stroke care is needed to produce a better quality of life, and a common strategy is implementing a clinical pathway [5]. A clinical pathway (CP) is a timetable that contains an integrated service plan based on the medical services standard provided to patients from admission to hospital discharge [6]. The CP implementation based on evidence-based medicine is designed to standardize the service process; hence it can reduce service variations and improve clinical outcomes.

Furthermore, hospitalization length is one of the clinical outcome indicators used in the CP evaluation [7]. Clinical pathways can reduce the average hospitalization length, reduce expenses, increase patient satisfaction and improve the care quality in stroke management [8]. Systematic reviews that measure the CP implementation to shorten the hospitalization length have not shown conclusive results [9]. Studies of implementing CP to hospitalization length should consider demographic and clinical confounders [10].

Hospitalization length is influenced by several conditions, including age, gender, comorbidities, clinical conditions at the admission time, and the services provided. Previous studies that measured the CP effectiveness were conducted in one hospital and had not considered confounding factors and the CP format. Therefore, this study aims to measure the use of ischemic stroke CP effect on the hospitalization length in several hospitals with a stroke registry by considering confounding factors, stroke services uniformity, and CP format.

2 Materials and Methods

A retrospective cohort design was used to compare hospitalization length in groups of ischemic stroke patients managed using clinical pathways. The independent variable is the ischemic stroke clinical pathway, while the dependent is hospitalization length, and the measured covariates include demographic factors (age, gender), comorbidities (hypertension, diabetes mellitus, dyslipidemia), clinical (disease severity, onset attack),

process services, and management support. Furthermore, the population was ischemic stroke patients admitted to the study hospital from January 2012 to December 2015. The sample selection was purposively limited by the inclusion criteria, as follows: 1). Ischemic stroke patients aged 18 years, 2). First attack affecting ischemic stroke patients (no history of stroke), 3). The patient's status is registered as new at the study hospital, 4). The patient leaves the hospital as permitted by the doctor in charge. Exclusion criteria were incomplete medical records and incomplete clinical pathway sheets, particularly for the 48 h of treatment.

Ischemic stroke cases managed using CP were obtained from the Medical Services Section or the home Neurology Department, while those managed without CP were obtained from the Stroke Disease Registry data collected at the Research and Development Agency. The medical records were traced from these two sources to obtain data on study variables. The diagnosis was determined based on the head CT Scan with the ICD-X code 163.9 in the medical record.

Meanwhile, hospitalization length is the number of days spent during treatment, calculated from the patients from admission to hospital discharge. Receiver Operating Characteristic (ROC) analysis was performed to get cut-off for the hospitalization length [11]. The Hospitalization length is categorized as long if $>$ cut-off value and short if $\leq$ cut-off value. Furthermore, covariate data on demographic factors of age and sex were obtained from medical records.

Hypertension, diabetes mellitus, and dyslipidemia data were collected from the patient's medical records. Clinical factors of disease severity were measured using a proxy level of consciousness based on the Glasgow Coma Scale (GCS) recorded in the medical record. Disease severity was grouped into 3 categories: mild severity when the patient was admitted to the hospital in a state of compos mentis consciousness (GCS 15), moderate severity when admitted to the hospital with somnolence soporos consciousness (GCS 9–14), and severe when admitted to the hospital in a coma (GCS 8). The onset attack is the time interval (hours) from symptoms appearing until the patient is admitted to the hospital, measured by copying medical records.

The service process is a composite variable of 3 indicators including assessment need 24 h of admission, antiplatelet drugs administration 24 h of admission, and neurological observation 48 h of admission, obtained by copying from medical records divided into 2 categories of complete and incomplete. The service process is complete when the three indicators are met, otherwise, it is considered a lack of service process.

As many as 35 informants consisting of leaders and health service providers (PPK) in each study hospital were interviewed using a structured questionnaire to obtain the proportion of management support overview for the CP implementation from January 2012 to December 2015. The data was calculated by comparing the total score of respondents' answers to the number ideal score of expected answers using tabulation in excel format and presented as percentages.

The study locations are a type A government hospital in Semarang, a type A government hospital in Jakarta, and a type B private hospital in Yogyakartawhichat have run a stroke registry, taking into account the Primary Stroke Center (PSC) services uniformity with at least 5 elements, including 1) stroke unit, 2) neuroimaging services operating 24

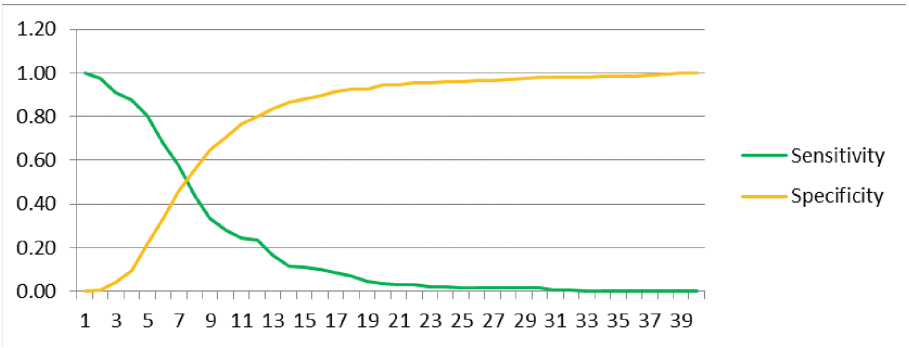

Fig. 1. Sensitivity and specificity curves of hospitalization length

h a day, 3) full-time neurologist, 4) acute stroke team, and 5) neurosurgeon [12]. In addition, the hospital has a uniform CP determined based on dimension 1 of the Integrated Clinical Pathway Appraisal Tools (ICPAT) instrument. This instrument ensures the CP format validity has at least 1) timeframe, 2) services activity, 3) outcome criteria and 4) variance recording [13].

Univariate analysis was performed to describe the subject's characteristics, and the Chi-square test was used to describe the relationship strength between variables using the Relative Risk (RR) calculation. A stratification test was performed to determine the interaction between independent and covariate variables. Subsequently, confounding control was carried out with multivariate analysis using the Cox regression test, a suitable method for estimating Relative Risk (RR) in cohort studies [14]. By setting the same follow-up time for all individuals (CP and without CP groups), the hazard ratio generated can estimate the Relative Risk value [11]. Study Ethics Approval was obtained from the Health Research and Development Agency Ethics Committee No: 154/H2.F10/PPM.00.02/2015, dated March 16, 2015.

3 Results

As many as 651 ischemic stroke patients met the inclusion criteria consisting of 462 (71%) without CP and 189 (29%) with CP groups. The median hospitalization length in three hospitals varies. The type A government hospital in Semarang (231 subjects) is 7 days, at type A government hospital in Jakarta (79 subjects) is 6 days, and 9 days at the type B private hospital in Yogyakarta (341 subjects). ROC analysis was performed to obtain a cut-off point with optimal sensitivity and specificity in the study population. From 651 subjects, the optimal cut-off point is at coordinates 7.5 with a sensitivity of 44% and a specificity of 56%. Therefore, the cut-off point for hospitalization length is 8 days, rounded off from 7.5 as illustrated in Fig. 1.

The patient characteristics show that 57.0% were male, 38.9% were aged 18–55 years, 65.3% of patients experienced short hospitalization length ($\leq$8 days), and 87.6% had dyslipidemia (Table 1). Regarding disease severity, 75.6% of admitted patients had mild severity (GCS 15) and 34.6% experienced an onset attack $>$ 24 h.

Table 1. Patients characteristics

Variables	Total (n)	Percentage (%)
Clinical pathway (CP)		
CP	189	29.0
Non-CP	462	71.0
Hospitalization length (days)		
Short (≤8)	425	65.3
Long (>8)	226	34.7
Age (years)		
>75	75	11.5
66-75	113	17.4
55-65	210	32.3
18-55	253	38.9
Gender		
Male	371	57.0
female	280	43.0
Hypertension		
Yes	508	78.0
No	43	22.0
Diabetes mellitus		
Yes	214	32.9
No	473	67.1
Dyslipidemia		
Yes	570	87.6
No	81	12.4
Disease severity		
Severe (GCS ≤8)	32	4.9
Moderate (GCS 9-14)	127	19.5
Mild (GCS 15)	492	75.6
Onset attack (hours)		
>24	225	34.6
13-24	157	24.1
7-12	92	14.1
3-6	108	16.6
<3	69	10.6
Service process		
Incomplete	518	79.6
Complete	133	20.4
Management support		
Low	612	94.0
High	39	6.0

Management support describes the proportion of hospital leadership and Commitment Making Officer (CMO) support for the development and CP implementation. The score of management support is 1.295, with an ideal score of 1.680, meaning that the overall management support is good (>77%). Most of the informants (94%) indicate a lack of management support for CP implementation.

The bivariate analysis results show that ischemic stroke patients who received CP were more likely to have 6% shorter hospitalization length days (≤8 days) than those who didn't receive CP (RR: 0.94; 95%CI: 0.75–1.19; p: 0.351). The risk of long hospitalization length days (>8 days) increased with patients' age and disease severity. Patients with diabetes mellitus were 1.45 times more likely to have longer hospitalization (RR: 1.45; 95%CI: 1.18–1.79; p: 0.001) compared to those who weren't having diabetes mellitus (Table 2).

Table 2. Bivariate analysis of hospitalization length based on the clinical pathway

Variables	Hospitalization length (days) Long (>8) n (%)	Short (≤8) n (%)	Total n (%)	RR	95%CI	P-value
Clinical Pathway						
CP	63 (33.3)	126 (66.7)	189 (100.0)	0.94	0.75-1.19	0.351
Non-CP	163 (35.3)	299 (64.7)	462 (100.0)	Ref		
Age						
>75 years old	37 (49.3)	38 (50.7)	75 (100.0)	1.66	1.12 – 2.47	0.005
66-75 years old	43 (38.1)	70 (61.9)	113 (100.0)	1.28	0.88 – 1.87	0.096
55-65 years old	71 (33.8)	139 (66.2)	210 (100.0)	1.14	0.82 – 1.58	0.213
18-55 years old	75 (29.6)	178 (70.4)	253 (100.0)	Ref		
Gender						
Male	128 (34.0)	245 (66.0)	371 (100.0)	0.95	0.92 – 1.15	0.351
Female	100 (35.7)	180 (64.3)	280 (100.0)	Ref		
Hypertension						
Yes	168 (33.1)	340 (66.9)	508 (100.0)	0.82	0.65 – 1.03	0.060
No	58 (40.6)	85 (59.4)	143 (100.0)	Ref		
Diabetes Mellitus						
Yes	94 (43.9)	120 (56.1)	214 (100.0)	1.45	1.18 – 1.79	0.000
No	132 (30.2)	305 (69.8)	437 (100.0)	Ref		
Dyslipidemia						
Yes	196 (34.4)	374 (65.6)	570 (100.0)	0.93	0.68-1.26	0.365
No	30 (37.0)	51 (63.0)	81 (100.0)	Ref		
Disease Severity						
Severe (GCS ≤ 8)	23 (71.9)	9 (28.1)	32 (100.0)	2.56	1.65 – 3.98	0.000
Moderate (GCS 9-14)	65 (51.2)	62 (48.8)	127 (100.0)	1.83	1.36 – 2.45	0.000
Mild (GCS 15)	138 (28.0)	354 (72.0)	492 (100.0)	Ref		
OnsetAttack						
>24 hours	79 (35.1)	146 (64.9)	225 (100.0)	1.05	0.66 – 1.68	0.413
13-24 hours	56 (35.7)	101 (64.3)	157 (100.0)	1.07	0.66 – 1.74	0.392
7-12 hours	28 (30.4)	64 (69.6)	92 (100.0)	0.91	0.53 – 1.59	0.373
3-6 hours	40 (37.0)	68 (63.0)	108 (100.0)	1.11	0.66 – 1.86	0.343
<3 hours	23 (33.3)	46 (66.7)	69 (100.0)	Ref		
Service Process						
Incomplete	172 (33.2)	346 (66.8)	518 (100.0)	0.82	0.64 – 1.04	0.068
Complete	54 (40.6)	79 (59.4)	133 (100.0)	Ref		
Management Support						
Low	213 (34.8)	399 (65.2)	612 (100.0)	1.04	0.66-1.65	0.494
High	13 (33.3)	26 (66.7)	39 (100.0)	Ref		

The stratification test showed no interaction between variables. Cox regression analysis was performed by including the independent variables and all covariates in the initial model (full model). Furthermore, the confounding test was conducted by comparing the RR value of the main variable before (RR crude) and after (RR adjusted). Disease severity and management support were not confounding variables but were substantially important and included in the final model.

The final Cox regression model in Table 3 shows that patients who didn't receive CP had a 53% risk of having longer hospitalization length days (>8 days) than those

Table 3. The final model of clinical pathway effect on hospitalization length

Variables	RR	95%CI	P-value
Clinical pathway (CP)			
CP	**0.47**	**0.24 – 0.93**	**0.020**
Non-CP	Ref		
Disease severity			
Severe (GCS ≤8)	2.53	0.63 – 3.95	0.000
Moderate (GCS 9-14)	1.80	1.34-2.41	
Mild (GCS 15)	Ref		
Management support			
Low	1.11	0.60 – 2.05	0.374
High	Ref		
Service process			
Incomplete	0.41	0.20-0.84	0.007
Complete	Ref		

who received CP, after controlling for disease severity, management support, and service process (RR: 0.47; 95%CI: 0.24–0.93; p: 0.020).

4 Discussion

This study was conducted in public and private hospitals, which have been running a stroke registry since 2012. The study location assessment was conducted based on the criteria for uniformity of Primary Stroke Center (PSC) services, and the CP format meets the 4 main components of Dimension 1 ICPAT. Therefore, the results can only be generalized to the eligible population, such as hospitals with similar criteria. The retrospective cohort study design strength is the investigation direction clarity that ensures the temporality principle, including cause (ischemic stroke CP) precedes effect (hospitalization length), and conformity with the causality principle [15].

This study found CP treatment on patients could reduce the risk of long hospitalization length (>8 days) by 53% compared to non-CP treatment after controlling for disease severity variables, management support, and service processes. This study controlled external factors such as demographics, comorbidities, clinical factors, service processes, and management support. Variables were defined as a confounder if the risk factor effect is distorted due to the association of the exposure factor to external factors. This is in response to El Baz's recommendation that a CP study on the effectiveness of hospitalized length should take into account demographic and clinical confounding factors [10]. The narrow confidence interval value and a significant association indicate that the coincidence factor (chance) doesn't affect the results.

Disease severity influenced the association between ischemic stroke CP and hospitalization length. Patients who were admitted with severe and moderate severity had 2.53 times and 1.80 times the risks of having treatment >8 days. This is consistent with previous studies which found that disease severity level at hospital admission was a significant predictor of hospitalization length [16, 17].

Furthermore, management support affects the clinician's compliance with CP implementation. A lack of management support for CP implementation in this study increased the risk of a long hospitalization stay by 1.11 times. A clinical pathway is an instrument

that contains services provided to patients by evidence-based medicine to standardize services. The role of hospital management and Commitment Making officers is very important in the successful implementation of CP. The three hospitals have been running CP for over 2 years, but the evaluation has not been conducted regularly. In this study, the service process showed negative results. The service process measurement using a composite variable of 3 indicators (assessment needs 24 h of admission, antiplatelet drugs administration 24 h of admission, and neurological observation within 48 h of admission) may cause this result. Therefore, the effect of each indicator cannot be measured, which can lead to a negative result. This study uses secondary data from medical records and cannot control the quality of the measurements made in the past.

This study is consistent with previous results, which found that CP implementation reduced hospitalization length [18]. Clinical pathways can decrease hospitalization length and average expenses, increase patient satisfaction, and improve the care quality in stroke management [8]. The clinical pathways can improve efficiency and quality, control health service costs, and reduce complications and hospitalization length [19–21]. In addition, the clinical pathways implication can decrease the hospitalization length in cesarean section patients at Dr. Soetomo Hospital and in acute coronary syndrome patients at Sardjito Hospital [22, 23]. Another study showed that there was a significant effect on the average hospitalization length for non-hemorrhagic stroke patients given a clinical nursing pathway [24].

The hospitalization length is one of the output indicators used as an outcome in a clinical pathway effectiveness study [7]. Previous studies that measured the CP effect still showed varied results, which may be due to not using the standard structure or format of CP used [25]. This bias was minimized by determining the location based on the standardized CP form that is used in hospitals, that meets the ICPAT Dimension 1 criteria [26, 27]. Integrated Clinical Pathway Appraisal Tools (ICPAT) is an instrument used to assess the CP content and quality, consisting of 1). Dimension 1: CP form validity, 2). Dimension 2: CP Documentation, 3). Dimension 3: CP development, 4). Dimension 4: CP implementation 5). Dimension 5: Maintenance, 6). Dimension 6: Organization [28]. No expert agreement in determining the cut-off point for the hospitalization length allows information bias in this study. Therefore, this study used ROC analysis to determine cut off point for the hospitalization length.

The three hospitals in this study have been conducting CP for over 2 years, but the evaluation has not been done regularly. The standard operating procedure (SOP) compiled in the clinical practice guidelines (PPK) form and supplemented with CP should be reviewed and updated at least every two years [29]. The monitoring and evaluation of CP implementation should improve the patient's clinical outcome. These efforts need to produce quality services at controlled costs, which are part of the National Health Insurance (JKN) policy objectives.

5 Conclusion

The ischemic stroke clinical pathway implementation in the three study hospitals significantly reduced the hospitalization length.

Acknowledgments. The authors are grateful to the hospital study team who helped in access data. We are also thankful to the enumerators for assisting in data collection, and the team of the Research and Development Agency for supporting the use of stroke registry data. Furthermore, the authors thank the Ministry of Health, lecturers, colleagues at FKM UI, and other parties who have helped conduct this research.

References

1. Singh PK. World Stroke Day. World Health Organization. 2021.
2. Kementerian Kesehatan. Riset Kesehatan Dasar (RISKESDAS) 2013. Lap Nas 2013. 2013; 1–384.
3. Riskesdas K. Hasil Utama Riset Kesehata Dasar (RISKESDAS). J Phys A Math Theor [Internet]. 2018; 44(8): 1–200. Available from: http://arxiv.org/abs/1011.1669%0A, https://doi.org/10.1088/1751-8113/44/8/085201%0A, http://stacks.iop.org/1751-8121/44/i=8/a=085201?key=crossref.abc74c979a75846b3de48a5587bf708f
4. Kementerian Kesehatan. Registri Stroke Indonesi Tahun 2012–2013. Jakarta: Badan Penelitian dan Pengembangan Kesehatan Kemenkes RI; 2013. 108 p.
5. Aniza I, Saperi S, Sm A. Clinical Pathway as a Strategy in Improving Healthcare Quality and Cost Containment. 2008; 3(2): 239–46.
6. Kinsman L, Rotter T, James E, Snow P, Willis J. What is a clinical pathway? Development of a definition to inform the debate. BMC Med [Internet]. 2010 May 27; 8: 31. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2893088/
7. van Bussel EF, Jeerakathil T, Schrijvers AJP. The process flow and structure of an integrated stroke strategy. Int J Integr Care [Internet]. 2013; 13(June): e025. Available from: http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=prem&NEWS=N&AN=23882172
8. Huang D, Song X, Tian J, Cui Q, Yang K. Effects of clinical pathways in stroke management: A meta-analysis. Neurol Asia [Internet]. 2015; 20(4): 335–42. Available from: http://web.a.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=ae33975a-1e87-4289-9773-737fa41a6da5%40sessionmgr4009&vid=1&hid=4101
9. Seehusen DA. Clinical Pathways: Effects o Practice, Outcomes, and Costs. Cochrane Clin. 2010; 82(11): 1339–40.
10. El Baz N, Middel B, Van Dijk JP, Oosterhof A, Boonstra PW, Reijneveld S. Are the Outcomes of Clinical Pathways Evidence - Based? A Critical Appraisal of Clinical Pathway Evaluation Research. J Eval Clin Pract. 2007; 13(6): 920–9.
11. Barros AJ, Hirakata VN. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. BMC Med Res Methodol. 2003; 13: 1–13.
12. Alberts MJ, Latchaw RE, Jagoda A, Wechsler LR, Crocco T, George MG, et al. Revised and updated recommendations for the establishment of primary stroke centers: A summary statement from the brain attack coalition. Stroke. 2011; 42(9): 2651–65.
13. Audimoolam S, Nair M, Gaikwad R, Qing C. The Role of Clinical Pathways in Improving Patient Outcomes. 2005; (February): 1–25.
14. Quijano FD. A simple method for estimating relative risk using logistic regression. BMC Med Res Methodol [Internet]. 2012; 12(1): 14. Available from: http://www.biomedcentral.com/1471-2288/12/14
15. Elwood M. Critical Appraisal of Epidemiology Studies and Clinical Trials. Third Edit. New York: Oxford University Press; 2007. 570 p.

16. Koton S, Bornstein NM, Tsabari R, Tanne D. Derivation and validation of the Prolonged Length of Stay score in acute stroke patients. Neurology [Internet]. 2010 May 11; 74(19): 1511 LP – 1516. Available from: http://n.neurology.org/content/74/19/1511.abstract
17. Saxena A, Prasad RN. Factors Predicting Length of Hospital Stay in Acute Stroke Patients Admitted in a Rural Tertiary Care Hospital. J Gerontol Geriatr Res [Internet]. 2016; 01(s5). Available from: https://www.omicsgroup.org/journals/factors-predicting-length-of-hospital-stay-in-acute-stroke-patients-admitted-in-a-rural-tertiary-care-hospital-2167-7182-S5-003.php?aid=76960
18. van Exel NJA, Koopmanschap MA, Scholte op Reimer W, Niessen LW, Huijsman R. Cost-effectiveness of integrated stroke services. QJM - Mon J Assoc Physicians. 2005; 98(6): 415–25.
19. Frei CR, Bell AM, Traugott KA, Jaso TC, Daniels KR, Mortensen EM, et al. A clinical pathway for community-acquired pneumonia: an observational cohort study. BMC Infecious Dis. 2011; 11(188): 2–6.
20. Milne TE, Rogers JR, Kinnear EM, Martin H V, Lazzarini PA, Quinton TR, et al. Developing an evidence-based clinical pathway for the assessment, diagnosis, and management of acute Charcot Neuro-Arthropathy: A systematic review. J Foot Ankle Res [Internet]. 2013; 6(1): 1. Available from Journal of Foot and Ankle Research
21. Zhang M. The application and practice of the electronic clinical pathway. J Transl Med [Internet]. 2012; 10(Suppl 2): A57. Available from: http://www.translational-medicine.com/content/10/S1/A57
22. Fitria A, Arman AS, Nurul TR, Purwaka BT, Widodo Jatim Pudjirajardjo. Penerapan Clinical Pathway sebagai Instrumen Pengendalian Biaya Pelayanan di Dr. Soetomo: Studi Penelitian Tindakan Penderita BPJS yang menjalani. Keperawatan Silampari. 2021; 4, Nomor 2: 593–9.
23. Pahriyani A, Andayan TM, Pramantara IDP. Pengaruh Implementasi Clinical Pathway Terhadap Luaran Klinik Dan Ekonomik Pasien Acute Coronary Syndrome. J Manaj dan Pelayanan Farm (Journal Manag Pharm Pract.) 2014; 4(3): 146–50.
24. Rezkiki F. Influence of Nursing Clinical Pathway Implementation To Length of Stay of Non Hemorrhagic Stroke Patients in Bukittinggi Achmad Mochtar Hospital. J Ipteks Terap. 2018; 12(1): 9.
25. Vanhaecht K. The impact of clinical pathways on the organisation of care processes. 2007.
26. GOSH. How to produce and evaluate an integrated care pathway (ICP): information for staff Submit revised. NHS Trust. 2010; (August): 1–22.
27. Whittle C. ICPAT: Integrated care pathways appraisal tool. Int J Care Pathways. 2009; 13(2): 75–7.
28. Whittle C, McDonald PS, Dunn L de LK. Developing the integrated care pathways appraisal tool (ICPAT): a pilot study. J Integr Care Pathways. 2004; 8(1): 77–81.
29. Kementerian Kesehatan. Peraturan Menteri Kesehatan RI No 1438 Tahun 2010 Tentang Standar Pelayanan Kedokteran. Jakarta; 2010.