

EFFECT OF CLINICAL PATHWAY ON LENGTH OF STAY AND HOSPITAL COST: A SYSTEMATIC REVIEW

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ABSTRACT

Background: Clinical pathway, also known as care pathway, integrated care pathway, critical pathway, or care map, is the standardization of medical and surgical care process. It can be used to assure the quality of health service, to reduce risk, to control cost, and to increase efficiency of resources use. However, not all cases need clinical pathway. This study aimed to review systematically the effect of clinical pathway on length of stay and hospital cost.

Subjects and Method: A systematic review was conducted by searching published articles from 2010 to 2019 from databases, including PubMed, ProQuest, and Cochrane. The inclusion criteria were articles published over the last 10 years, randomization, experiment, cohort, English, full text, and open access.

Results: After screening based on inclusion criteria, 13 articles were included in this review. All of the studies investigated inpatient cases, with 10 out of 13 studies performed surgical cases, including of total hip arthroplasty, sphenopalatine artery ligation, pediatric appendectomy, total knee arthroplasty, endocrine operations, hepatic surgery, surgery for uterine fibroids, radical cystectomy, open pulmonary lobectomy and bilobectomy, non-surgical cases of asthma, and neonatal jaundice. All studies measured hospital length of stay. Nine studies looked at the effect on costs. Other effects include resource efficiency, surgical waiting time, complication, and readmission.

Conclusion: Clinical Pathway has a positive effect in the reduction of hospital length of stay and costs. It can be carried out for surgical and non-surgical cases with monitoring and evaluation during implementation.

Keywords: clinical pathway, length of stay, cost

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BACKGROUND

Total health expenditure in Indonesia has increased year by year. It can be seen through a portrait of the data of Indonesia's health expenditure from 2010 to 2016 in the NHA (National Health Account) report of the Ministry of Health of the Republic of Indonesia. In 2010, the value reached 211.2 trillion rupiah. In 2016, it almost doubled by 414.0 trillion rupiah. If we look at the picture of expenditure according to the provider and its function in 2016, the largest health expenditure was dominated

by hospitals by 57.5 %, where the 37.7% was spent in inpatient curative services, 17.2% in outpatient curative services, and 2.6% absorbed in the form of investment (PPJK Ministry of Health and University of Indonesia, 2018).

Due to the large portion of health expenditure at hospitals as providers, various measures in controlling costs and the quality of health services need to be carried out. In the past, there was little incentive for hospitals to monitor patient safety and the use of resource. At that time, the hospital

system was still simple, with no concept related to service quality and management processes. It changed drastically in the last few centuries. National and international attention to service quality issues such as substandard services, varied services, and waiting times have made hospital management and specialist doctors aware that service delivery in hospitals needs to be reorganized (Campbell et al., 1998).

Clinical pathways (CP) have been developed in health services as a multidisciplinary care plan. It is related to the chronology and action needed to reach the expected patient outcomes and organizational goals in the form of quality, cost, patient satisfaction, and efficiency. The concept of CP refers to specific care guidelines that describe the patient's treatment goals and determine the chronology of intervention given to reach goals efficiently (Cannon and Cardiac, 2000).

In the era of the National Health Insurance (NHI), through prospective payment patterns to providers, it used package rates in the form of DRG (diagnostic related groups). It became one of the tools for quality control and health costs in hospitals. However, it needs to be followed by a good implementation of clinical pathway in hospitals.

Clinical pathways (CP) are introduced to assure the quality, to reduce risk, efficiency of resources use, and control cost. However, not all cases need CP. The study aimed to identify and conclude published studies where the CP was applied in hospitals and their effects on two main outcomes in the form of length of stay and hospital cost, in addition to other effects.

SUBJECTS AND METHOD

1. Study Design

This study was conducted through a systematic literature review of studies related

to the published clinical pathways in 2010 to 2019. The literature search was carried out through 3 databases in PubMed, ProQuest, and Cochrane databases of systematic review comprehensively.

This study was conducted 9 days from 16 to 24 April 2019. These studies were identified by keywords of clinical pathways, length of stay, LOS and costs based on the PICO framework (population, intervention, comparator, outcome), with the reference of PRISMA (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) protocol (Liberati et al., 2009).

2. Inclusion and Exclusion Criteria

The Inclusion and exclusion criteria were applied at all ages and indications where there was the involvement of clinical pathway. These studies were limited in the form of full-text studies, in English with humans as study subjects in the past 10 years as a eligibility criterion. The inclusion and exclusion criteria were implemented immediately by screening the title and abstract. The selected titles and abstracts of the articles were read and examined briefly to see and find the suitability regarding correlation with this study before examining deeper the whole article.

Articles were excluded when using the word "clinical" or "Pathway" or "LOS" without any correlation between the implementation of CP with length of stay and cost. Studies on primary services, or not in a hospital context, or articles that did not provide quantitative results such as letters to editors, short reports, case studies, qualitative designs and expert opinions would not be included in this study.

3. Extraction Data

Based on the results of the study, there were 323 published articles in the database analyzed and 185 articles that did not meet the criteria. Based on manual selection conducted on 138 other articles with eligibility

criteria, there were 125 manuscripts that were excluded from this study because there was no CP involvement, inappropriate outcomes, non-hospital context, study design and methodology that did not meet the inclusion criteria.

Thirteen out of 323 studies investigated the effects of the implementation of CP in accordance with the objective of this study. The researchers used these studies with a systematic review.

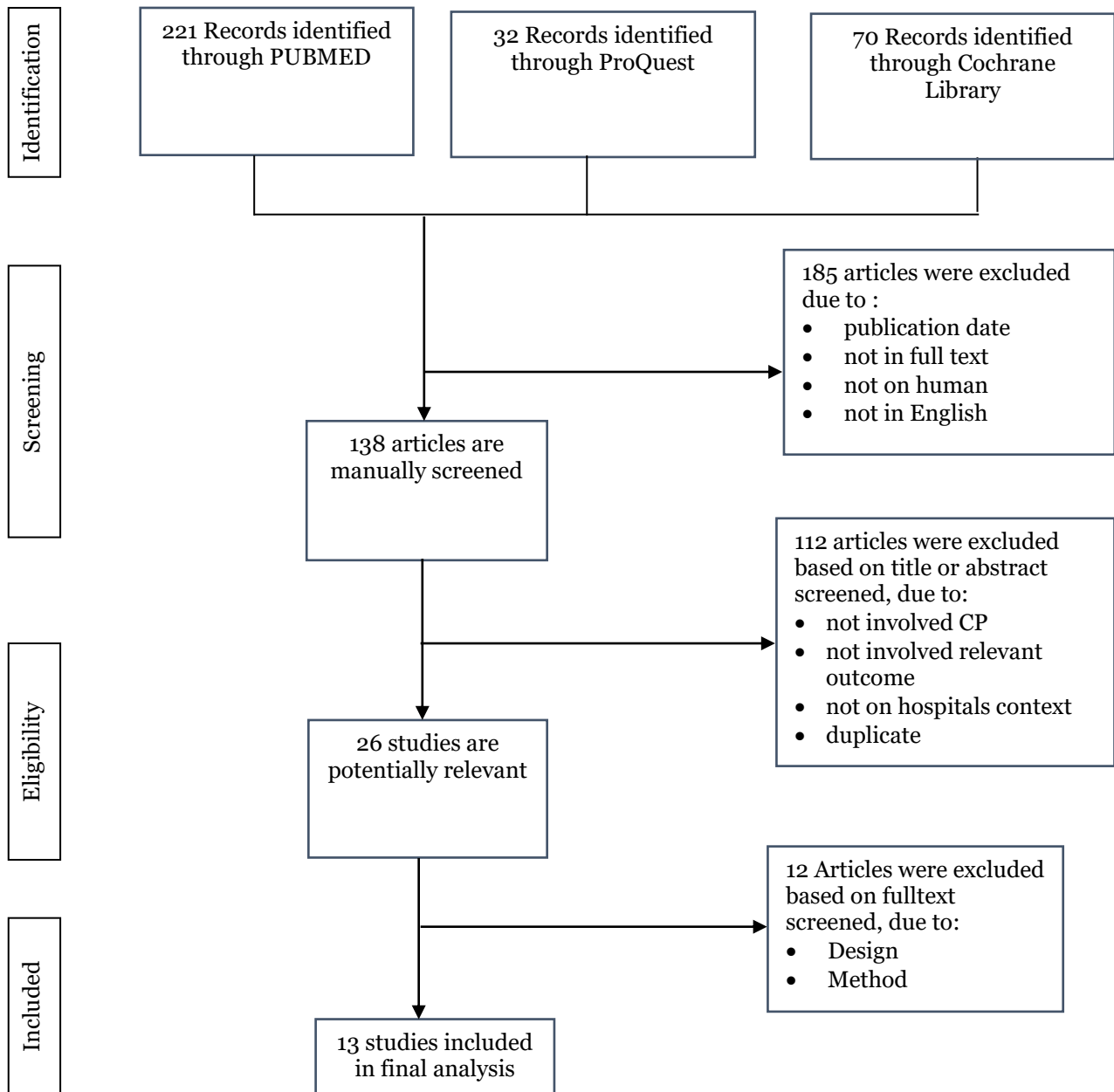


Figure 1. PRISMA method flowchart

RESULTS

There were thirteen studies which were synthesized: 8 studies were from the USA, 3 from China, 1 from Germany, and 1 from UK. All of these studies were inpatient

cases, with 10 of the 13 studies conducted on surgical cases in the form of total hip arthroplasty, sphenopalatine artery ligation, pediatric appendectomy, total knee arthroplasty, endocrine operations, hepatic

surgery (2 studies), surgery for uterine fibroid, radical cystectomy, open pulmonary lobectomy and bilobectomy, and 3

non-surgical cases of asthma (2 studies), and neonatal jaundice. For details, it can be seen in table 1 below.

Table 1. The characteristic of the selected study

First Author	Country	Sample Size (N)	Diagnosis/Intervention
Surgical			
Featherall, 2018	USA	6.090	Total Hip Arthroplasty
Semerjian, 2018	UK	110	Radical cystectomy
Vosler, 2016	USA	64	Severe epistaxis, early sphenopalatine artery ligation
Zhu, 2014	China	133	Hepatic surgery, hepatocellular carcinoma (HCC) hepatectomy
Putnam, 2014	USA	794	Pediatric appendectomy SDD
Xuping, 2014	China	775	Surgery for uterine fibroid
Duncan, 2013	USA	108	Total knee arthroplasty
Lin, 2011	China	117	Elective liver resection
Kulkarni, 2011	USA	681	Endocrine operations (ie, unilateral thyroid lobectomy, total thyroidectomy, parathyroidectomy)
Schwarzbach, 2010	Germany	81	Open pulmonary lobectomy and bilobectomy
Non-Surgical			
Kaiser, 2018	USA	189.331	Asthma
Bartlett, 2017	USA	297	Asthma exacerbations
Romero, 2018	USA	186	Neonatal jaundice

*Note: USA=United States of America, UK=United Kingdom

The selected article provided an overview related to economic data with which focus on the length of stay in the hospital and its effect on costs, but not in the form of a full economic evaluation. This study also showed that there was a correlation between the

implementation of CP and the reduce the drug use, readmissions, complications and waiting time for surgery in the hospitals. Specifically, the characteristics of the articles we included in the study can be seen in Table 2.

Table 2. The effect of CP on LOS, Cost, and Outcome

Article Title	Research Design	Outcome	Results
Effectiveness of Pediatric Asthma Pathways for Hospitalized Children: A Multicenter, National Analysis (Kaiser et al., 2018)	Retrospective, cohort study	LOS	↓ 8,8%, (95% CI 6.7%-10.9%)
		Cost	↓ 3.1%, (95% CI 1.9%-4.3%)
		Bronchodilator administration OR	↑ 1.53, (1.21-1.95)
		Antibiotic administration OR	↓ 0.93, (0.87-0.99)

Implementation of a Total HipArthroplasty Care Pathway at a High-Volume Health System: Effect on Length of Stay, Discharge Disposition, and 90-Day Complications (Featherall et al., 2018)	Retrospective, cohort study	LOS	↓ 0.747; 95% [CI; 0.727, 0.767]], preCP 3.21 days (1.50), Transition 2.80 days (1.39) , postCP 2.55 days (1.46)
		Discharges to home OR cost reduction per capita	↓ 2.079; 95% CI [1.762, 2.456] \$1,329
		90-day complications	↓ 1.023; 95% CI [0.841, 1.245]
Neonatal Jaundice: Improved Quality and Cost Savings After Implementation of a Standard Pathway (Romero et al., 2018)	Observational	LOS	↓ 1.30 days for 117 prepathway patients compared with 0.87 days for 69 postpathway patients (P < .001).
		Efficiency ;phototherapy initiation	↓ 101.26 minutes for 14 prepathway patients compared with 54.67 minutes for 67 postpathway patients
		intravenous fluid orders	↓ from 80% to 44% (P < .001)
		Mean cost Inpatient used	↓ \$ 4767 to \$ 3989 66% , compared with 50% (P = .01)
Hospital Charges and Length of Stay Following Radical Cystectomy in the Enhanced Recovery After Surgery Era (Semerjian et al., 2018)	Observational	The median LOS	↓ 5.0 days in the ERAS group and 8.5 days in the pre-ERAS group (P = < .001)
		use of nasogastric tube	↓ 13.8% vs. 30.0%, p<0.05
		parenteral nutrition	↓ 6.9% vs. 20.4%, p<0.05
		The overall complication rate	↓ 51.7% in the ERAS group and 62.0% in the pre-ERAS group, P = .28
		Thirty- and 90-day readmissions	↓ 19.0% vs 14.8%, p = 0.550 and 31.0% vs 27.7%, p = 0.640
		Hospital charges	↓ \$31,090 (9,912) \$35,489 (21,069) p= 0.036
Improving the Efficiency of Care for Pediatric Patients Hospitalized With Asthma (Bartlett et al., 2017)	Observational	The ALOS	↓ 2.9 days to 2.3 day
		direct cost index	↓ 1.5 to 1.1
Successful Implementation of a Clinical Care Pathway for Management of Epistaxis at a Tertiary Care Center (Vosler et al., 2016)	Observational	Hospital stay	↓ 5.2 ± 3.9 to 2.1 ± 1.3 days; p < .001
		number of days packed	↓ 3.2 ± 1.6 to 1.4 ± 1.6; p = .001
		overall cost of hospitalization	↓ 66% (\$9435 saved)
Impact of a clinical pathway on hospital costs, length of stay	Experimental	LOHS	↓ 8.3 versus 12.3 days, p<0.001

and early outcomes after hepatectomy for hepatocellular carcinoma (Li et al., 2014)		The hospital costs	↓ 24,844 RMB to 19,761 RMB in the CP group (p<0.01)
Impact of a 24-hour discharge pathway on outcomes of pediatric appendectomy (Putnam et al., 2014)	Prospective cohort	Hospital LOS	↓ 35 (20-50) hours to 22 (9-55) hours (p<0.001)
		Cost saving	\$3,090 to 2,719
		Same day discharges	↑ 13% to 58% (p<0.001)
		Infectious complications	↑ 1.6% vs 1.8%, p = 0.820
		readmissions	↑ 1.2% vs 4.2%, p = 0.020
Effects of clinical pathways used in surgery for uterine fibroids: a meta-analysis (Peizhen et al., 2014)	Meta-analysis	average length of stay	↓ MD =-1.61; 95% CI (-1.91 - 1.31); p < 0.001)
		days of waiting for surgery	↓ MD = -0.75; 95% CI (-1.06, -0.44); p < 0.001
		inpatient expenditures	↓ MD =-1197.69; 95% CI (-1582.04, -813.35); p< 0.001)
A self-paired comparison of perioperative outcomes before and after implementation of a clinical pathway in patients undergoing total knee arthroplasty (Duncan et al., 2013)	Retrospective, observational	LOS	↓ 3.4 vs 4.4 days; p < 0.001
		total direct hospital costs	↓ \$956; 95% confidence interval, \$233-\$1785; p = 0.020
Implementation of a fast-track clinical pathway decreases postoperative length of stay and hospital charges for liver resection (Lin et al., 2011)	Experimental	LOS	↓ 7 vs. 11 days, p < 0.010
		The average perioperative hospital charges	↓ RMB 26,626 to RMB 21,004 (p < 0.050)
Clinical pathways improve hospital resource use in endocrine surgery (Kulkarni et al., 2011)	Retrospective, observational	LOS	↓ thyroid lobectomy: 1.6 days versus 1.0; p < 0.001
			↓ total thyroidectomy: 2.8 versus 1.1; p < 0.001
			↓ parathyroidectomy:1.6 versus 1.1; p < 0.001
		Total charges	↓ \$21,941 to \$17,313 for all cases 21% reduction; p < 0.001
Effects of a clinical pathway of pulmonary lobectomy and bilobectomy on quality and cost of care (Schwarzbach et al., 2010)	Observational	Hospital stay	↓ 16 vs 13 days p = 0.003
		Hospital cost	↓ 8,608 euro vs 6,994 euro p = 0.003

The effect of the implementation of CP on length of stay or LOS/ALOS

Overall studies reported the effect of the implementation of CP on length of stay as an indicator for both surgical and non-surgical cases. The unit used was in the

form of day care except a study conducted by Putnam et al., 2014 which used the unit of minutes because the study found the effect on appendectomy surgery on the same day (24 hours).

The effect of clinical pathway was quite large seen in surgical intervention such as Radical cystectomy, Severe epistaxis with early sphenopalatine artery ligation, Hepatic surgery for hepatocellular carcinoma (HCC) hepatectomy, liver resection, Open pulmonary lobectomy and bilobectomy. If CP was implemented to these interventions, it could reduce the length of stay for 3 to 4 days. In addition, the effect of CP for non-surgical cases in affecting length of stay was not more than 1 day.

The effect of the implementation of clinical pathway on hospital cost

Based on the 13 articles involved in this study, 9 studies showed the effect of CP implementation on hospital cost. However, it was not explained in detail whether an economic evaluation was carried out in the form of a cost analysis or a full economic evaluation. Another 4 studies only showed the potential for an average decline or fund that could be saved if CP was applied to each intervention.

Variations were also found in the way costs were calculated, as in the study conducted by Featherall et al. 2018 that used a per-diem payment pattern where CP could reduce per capita costs by \$ 1,329. In other studies, it used total costs and some of them did not explain in detail what costs were included in the calculation of these costs.

The effect of the implementation of CP on other outcomes

The implementation of CP could be correlated with efficiency of resource use. There was a decrease in the use of antibiotics (OR=0.93; 99%CI=0.87-0.99), chest radiograph (OR=1.04; 99%CI=0.99-1.10), and the use of Ipratropium (OR=0.97; 99%CI=0.89-1.07) on the implementation of CP for pediatric Asthma cases by using

multisector data analysis (Kaiser et al., 2018).

The implementation of CP also affected 90-days complication. A study conducted by Featherall et al in 2018 showed that the total hip Arthroplasty procedure with CP could reduce complication (OR=1.02; 95%CI=0.84-1.25). However, a study conducted by Putnam et al. in 2014 showed that the result was not different from complication before and after CP.

According to Putnam et al. (2014), the implementation of CP could increase readmissions from 1.2% at the beginning to 4.2% (p=0.200). However, according to Romero et al in 2018, there was no increase in readmissions for neonatal jaundice cases using the standard pathway.

Based on a systematic study review and meta-analysis conducted by Xuping (2014) on the surgical procedure of uterine fibrinoids with 10 studies involving 775 patients, there was a decreased mean difference between waiting time when conducting the procedure (MD= -0.75; 95%CI= -1.06-0.44; p<0.001) and CP.

According to Romero (2018), the improvement of clinical condition and expected outcome required the implementation and monitoring of evidence-based CP in neonatal jaundice management.

DISCUSSION

Clinical pathway gave benefits in managing patients to achieve the expected goals efficiently. CP had a positive effect in reducing length of stay and hospital cost. Based on the collected studies, CP could be carried out for diagnosis or for surgical and non-surgical cases with monitoring and evaluation during implementation.

Payment systems in hospitals that provide incentives could affect the implementation of CP where providers would try to make strategies to reduce LOS and cost

through CP. Each country has a different payment system. However, most of health insurance schemes such as in the USA (public) use payment system in DRG and per diem, as well as in the UK and Germany (Wenzl, 2015).

Indonesia, with its national health insurance system and INA CBGs package payment patterns, is well aware of the importance of implementing CP in hospitals. Implementing CP in the JKN era will provide incentives for hospitals, improve outcomes and patient satisfaction. The government has also implemented the 2012 version of hospital regulation and accreditation standard (Department of Health, 2012).

The implementation of the evidence-based CP can be increased in hospitals for both surgical and non-surgical services. In addition, it can be increased in hospital inpatient services with monitoring and evaluation during implementation.

REFERENCES

- Bartlett KW, Parente VM, Morales V, Hauser J, McLean HS (2017). Improving the Efficiency of Care for Pediatric Patients Hospitalized With Asthma. *Hospital Pediatrics*, 7(1): 31–38. <https://doi.org/10.1542/hpeds.2016-0108>
- Campbell H, Hotchkiss R, Bradshaw N, Porteous M (1998). Integrated care pathways. In *BMJ* 316:133–137.
- Cannon CP, Cardiac A (2000). AHA Scientific Statement. *AHA Journals*, 101: 461–465.
- Depkes. (2012). Peraturan Menteri Kesehatan Republik Indonesia Nomor 012 Tahun 2012 Tentang Akreditasi Rumah Sakit. Ditjen2PP.Kemenumham.co.id, (413).
- Duncan CM, Moeschler SM, Horlocker TT, Hanssen AD, Hebl JR (2013). A self-Paired comparison of perioperative outcomes before and after implementation of a clinical pathway in patients undergoing total knee arthroplasty. *Regional Anesthesia and Pain Medicine*, 38(6): 533–538. <https://doi.org/10.1097/AAP.000000000000014>
- Featherall J, Brigati DP, Faour M, Messner W, Higuera CA (2018). Implementation of a Total Hip Arthroplasty Care Pathway at a High-Volume Health System: Effect on Length of Stay, Discharge Disposition, and 90-Day Complications. *Journal of Arthroplasty*, 33(6): 1675–1680. <https://doi.org/10.1016/j.arth.2018.01.038>
- Kaiser SV, Rodean J, Bekmezian A, Hall M, Shah SS, Mahant S, ... Cabana MD (2018). Effectiveness of Pediatric Asthma Pathways for Hospitalized Children: A Multicenter, National Analysis. *Journal of Pediatrics*, 197: 165-171.e2. <https://doi.org/10.1016/j.jpeds.2018.01.084>
- Kulkarni RP, Ituarte PHG, Gunderson D, Yeh MW (2011). Clinical pathways improve hospital resource use in endocrine surgery. *Journal of the American College of Surgeons*, 212(1): 35–41. <https://doi.org/10.1016/j.jamcollsurg.2010.09.016>
- Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JPA, Moher D (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *J Clin Epidemiol*, 62(10): e1-34. <https://doi.org/10.1016/j.jclinepi.2009.06.006>
- Lin DX, Li X, Ye QW, Lin F, Li LL, Zhang QY (2011). Implementation of a Fast-Track Clinical Pathway Decreases Postoperative Length of Stay and Hospital Charges for Liver Resection. *Cell Biochemistry and Biophysics*, 61(2):

- 413–419. <https://doi.org/10.1007/s12-013-011-9203-7>
- Peizhen Z, Xuping S, Jinhui T, Qi C, Guowu D, Kehu Y. (2014). Effects of clinical pathways used in surgery for uterine fibroids: A meta-analysis. *Journal of Cancer Research and Therapeutics*, 10(1): 180. <https://doi.org/10.4103/0-973-1482.131460>
- PPJK Kemenkes dan Universitas Indonesia. (2018). Laporan NHA Indonesia 2016 (Lampiran).
- Putnam LR, Levy SM, Johnson E, Williams K, Taylor K, Kao LS, Tsao K (2014). Impact of a 24-hour discharge pathway on outcomes of pediatric appendectomy. *Surgery (United States)*, 156(2): 455–461. <https://doi.org/10.1016/j.surg.2014.03.030>
- Romero HM, Ringer C, Leu MG, Beardsley E, Kelly K, Fesinmeyer MD, ... Migita D (2018). Neonatal Jaundice: Improved Quality and Cost Savings After Implementation of a Standard Pathway. *Pediatrics*, 141(3): e20161472. <https://doi.org/10.1542/peds.2016-1472>
- Schwarzbach M, Rössner E, Schattenberg T, Post S, Hohenberger P, Ronellenfisch U (2010). Effects of a clinical pathway of pulmonary lobectomy and bilobectomy on quality and cost of care. *Langenbeck's Archives of Surgery*, 395(8): 1139–1146. <https://doi.org/10.1007/s00423-010-0600-y>
- Semerjian A, Milbar N, Kates M, Gorin MA, Patel HD, Chalfin HJ, ... Bivalacqua TJ (2018). Hospital Charges and Length of Stay Following Radical Cystectomy in the Enhanced Recovery After Surgery Era. *Urology*, 111: 86–91. <https://doi.org/10.1016/j.urology.2017.09.010>
- Vosler PS, Kass JI, Wang EW, Snyderman CH (2016). Successful Implementation of a Clinical Care Pathway for Management of Epistaxis at a Tertiary Care Center. *Otolaryngology - Head and Neck Surgery (United States)*, 155(5): 879–885. <https://doi.org/10.1177/019-4599816657045>
- Wenzl M (2015). Mossialos Health Systems Profiles.
- Zhu L, Li J, Li XK, Feng JQ, Gao JM (2014). Impact of a Clinical Pathway on Hospital Costs, Length of Stay and Early Outcomes after Hepatectomy for Hepatocellular Carcinoma. *Asian Pacific Journal of Cancer Prevention*, 15(13): 5389–5393. <https://doi.org/10.7314/apjcp.2014.15.13.5389>