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 bilopectomy, 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 Reposting 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.

**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

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**Figure 1. PRISMA method flowchart**

121 Records identified through PUBMED

32 Records identified through ProQuest

70 Records identified through Cochrane Library

185 articles were excluded due to:
- publication date
- not in full text
- not on human
- not in English

112 articles were excluded based on title or abstract screened, due to:
- not involved CP
- not involved relevant outcome
- not on hospitals context
- duplicate

26 studies are potentially relevant

13 studies included in final analysis

12 Articles were excluded based on fulltext screened, due to:
- Design
- Method
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

<table>
<thead>
<tr>
<th>First Author</th>
<th>Country</th>
<th>Sample Size (N)</th>
<th>Diagnosis/Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Featherall, 2018</td>
<td>USA</td>
<td>6,090</td>
<td>Total Hip Arthroplasty</td>
</tr>
<tr>
<td>Semerjian, 2018</td>
<td>UK</td>
<td>110</td>
<td>Radical cystectomy</td>
</tr>
<tr>
<td>Vosler, 2016</td>
<td>USA</td>
<td>64</td>
<td>Severe epistaxis, early sphenopalatine artery ligation</td>
</tr>
<tr>
<td>Zhu, 2014</td>
<td>China</td>
<td>133</td>
<td>Hepatic surgery, hepatocellular carcinoma (HCC) hepatectomy</td>
</tr>
<tr>
<td>Putnam, 2014</td>
<td>USA</td>
<td>794</td>
<td>Pediatric appendectomy SDD</td>
</tr>
<tr>
<td>Xuping, 2014</td>
<td>China</td>
<td>775</td>
<td>Surgery for uterine fibroid</td>
</tr>
<tr>
<td>Duncan, 2013</td>
<td>USA</td>
<td>108</td>
<td>Total knee arthroplasty</td>
</tr>
<tr>
<td>Lin, 2011</td>
<td>China</td>
<td>117</td>
<td>Elective liver resection</td>
</tr>
<tr>
<td>Kulkarni, 2011</td>
<td>USA</td>
<td>681</td>
<td>Endocrine operations (ie, unilateral thyroid lobectomy, total thyroidectomy, parathyroidectomy)</td>
</tr>
<tr>
<td>Schwarzbach, 2010</td>
<td>Germany</td>
<td>81</td>
<td>Open pulmonary lobectomy and bilobectomy</td>
</tr>
<tr>
<td>Kaiser, 2018</td>
<td>USA</td>
<td>189,331</td>
<td>Asthma</td>
</tr>
<tr>
<td>Bartlett, 2017</td>
<td>USA</td>
<td>297</td>
<td>Asthma exacerbations</td>
</tr>
<tr>
<td>Romero, 2018</td>
<td>USA</td>
<td>186</td>
<td>Neonatal jaundice</td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>Article Title</th>
<th>Research Design</th>
<th>Outcome</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effectiveness of Pediatric Asthma Pathways for Hospitalized Children: A Multicenter, National Analysis (Kaiser et al., 2018)</td>
<td>Retrospective, cohort study</td>
<td>LOS</td>
<td>↓ 8.8%, (95% CI 6.7%-10.9%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cost</td>
<td>↓ 3.1%, (95% CI 1.9%-4.3%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bronchodilator administration OR</td>
<td>↑ 1.53, (1.21-1.95)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Antibiotic administration OR</td>
<td>↓ 0.93, (0.87-0.99)</td>
</tr>
<tr>
<td>Study Title</td>
<td>Study Design</td>
<td>Methodology</td>
<td>LOS Improvement</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>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 (Featherall et al., 2018)</td>
<td>Retrospective, cohort study</td>
<td>↓ 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)</td>
<td>↓ 2.079; 95% CI [1.762, 2.456]</td>
</tr>
<tr>
<td>Neonatal Jaundice: Improved Quality and Cost Savings After Implementation of a Standard Pathway (Romero et al., 2018)</td>
<td>Observational</td>
<td>↓ 1.30 days for 117 prepathway patients compared with 0.87 days for 69 postpathway patients (P &lt; .001).</td>
<td>↓ 101.26 minutes for 14 prepathway patients compared with 54.67 minutes for 67 postpathway patients from 80% to 44% (P &lt; .001)</td>
</tr>
<tr>
<td>Hospital Charges and Length of Stay Following Radical Cystectomy in the Enhanced Recovery After Surgery Era (Semerjian et al., 2018)</td>
<td>Observational</td>
<td>The median LOS ↓ 5.0 days in the ERAS group and 8.5 days in the pre-ERAS group (P = .001)</td>
<td>↓ 13.8% vs. 30.0%, p &lt; 0.05</td>
</tr>
<tr>
<td>Improving the Efficiency of Care for Pediatric Patients Hospitalized With Asthma (Bartlett et al., 2017)</td>
<td>Observational</td>
<td>The ALOS ↓ 2.9 days to 2.3 days</td>
<td>direct cost index ↓ 1.5 to 1.1</td>
</tr>
<tr>
<td>Successful Implementation of a Clinical Care Pathway for Management of Epistaxis at a Tertiary Care Center (Vosler et al., 2016)</td>
<td>Observational</td>
<td>Hospital stay ↓ 5.2 ± 3.9 to 2.1 ± 1.3 days; p &lt; .001</td>
<td>number of days packed ↓ 3.2 ± 1.6 to 1.4 ± 1.6; p = .001</td>
</tr>
<tr>
<td>Impact of a clinical pathway on hospital costs, length of stay</td>
<td>Experimental</td>
<td>LOHS ↓ 8.3 versus 12.3 days, p&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>
and early outcomes after hepatectomy for hepatocellular carcinoma (Li et al., 2014)

Impact of a 24-hour discharge pathway on outcomes of pediatric appendectomy (Putnam et al., 2014)
- Prospective cohort
- Hospital LOS
- Cost saving
  - Hospital costs ↓ 24,844 RMB to 19,761 RMB in the CP group (p<0.01)
  - 35 (20-50) hours to 22 (9-55) hours (p<0.001)
  - $3,090 to 2,719
  - 13% to 58% (p<0.001)
  - 1.6% vs 1.8%, p = 0.820
  - 1.2% vs 4.2%, p = 0.020
  - MD = -1.61; 95% CI (-1.91 - 1.31); p < 0.001
  - MD = -0.75; 95% CI (-1.06, -0.44); p < 0.001
  - MD = -1197.69; 95% CI (-1582.04, -813.35); p < 0.001
  - 3.4 vs 4.4 days; p < 0.001
  - $956; 95% confidence interval, $233-$1785; p = 0.020

Effects of clinical pathways used in surgery for uterine fibroids: a meta-analysis (Peizhen et al., 2014)
- Meta-analysis
- Hospital stay
- Cost saving
  - LOS ↓ 1.6 days versus 1.0; p < 0.001
  - Total thyroidectomy: 2.8 days versus 0.001
  - Parathyroidectomy: 1.6 days versus 1.1; p < 0.001
  - $21,941 to $17,313 for all cases 21% reduction; 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
- Total direct hospital costs
  - ↓ 7 vs. 11 days, p < 0.010
  - RMB 26,626 to RMB 21,004 (p < 0.050)

Implementation of a fast-track clinical pathway decreases postoperative length of stay and hospital charges for liver resection (Lin et al., 2011)
- Experimental
- The average perioperative hospital charges

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 days versus 1.1; p < 0.001
  - parathyroidectomy: 1.6 days versus 1.1; p < 0.001
  - $21,941 to $17,313 for all cases 21% reduction; p < 0.001

Total charges
down ↓ 7 vs. 11 days, p < 0.010
RMB 26,626 to RMB 21,004 (p < 0.050)

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) heptectomy, 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-day 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 perdiem, 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.

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