THE EFFECT OF CLINICAL PATHWAY COMPLIANCE IN REDUCING LENGTH OF STAY

Pengaruh Kepatuhan Alur Klinis Dalam Menurunkan Lama Rawat Inap

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ABSTRACT

Background: Clinical pathway is multidisciplinary care plan based on the best clinical practice for a group of patients with a particular diagnosis, designed to minimize care delay as well as maximize the quality of care and clinical outcomes. In 2017, average length of stay for pediatric patient with acute gastroenteritis was prolonged even clinical pathways had been implemented.

Aim: This study determined the diagnostic examination and therapy compliance of clinical pathway related to the length of stay.

Method: This study was cross sectional research through simple random sampling. Researchers analyzed pediatric patients whose clinical pathway were filled completely by doctors. The inclusion criteria were pediatric patients, admitted to hospitals during January to December 2018 as acute gastroenteritis patients. The data were analyzed using multiple classification analysis.

Results: There were 197 patients with clinical pathway filled completely. As much as 60.91% of cases were compliant for diagnostic examination and 88.32% for therapy. There was no statistically significant correlation between diagnostic examination compliance (p > 0.05) and therapy compliance (p > 0.05) of clinical pathway with patients’ length of stay (combined = p > 0.05).

Conclusion: Many factors could be related with the length of stay especially patients’ condition itself. In this study, clinical pathway compliance has no impact in reducing length of stay.

Keywords: clinical pathway, compliance, length of stay, pediatric.

ABSTRAK

Latar Belakang: Alur klinis merupakan rencana perawatan multidisiplin berdasarkan praktik klinis terbaik untuk sekelompok pasien dengan diagnosis tertentu, yang dirancang untuk meminimalkan keterlambatan perawatan, memaksimalkan kualitas perawatan, dan hasil klinis. Pada tahun 2017, rerata lama rawat inap pada kasus gastroenteritis anak-anak memanjang meskipun implementasi alur klinis telah dilakukan.

Tujuan: Tujuan penelitian kami adalah untuk menentukan apakah kepatuhan pemeriksaan diagnostik dan terapi pada alur klinis berhubungan dengan lama rawat inap.

Metode: Desain penelitian ini adalah cross sectional dengan simple random sampling. Kami menganalisis pasien anak yang alur klinisnya disi sepenuhnya oleh dokter. Kriteria inklusi adalah anak-anak, dirawat di rumah sakit selama Januari hingga Desember 2018 dengan gastroenteritis akut. Data dianalisis dengan analisis klasifikasi ganda.

Hasil: Terdapat 197 pasien dengan alur klinis telah terisi lengkap, dimana sebesar 60,91% dari total kasus yang ada telah patuh terhadap kriteria pemeriksaan diagnostik dalam alur klinis dan sebesar 88,32% pada bagian terapi. Tidak ada hubungan yang signifikan secara statistik antara kepatuhan pemeriksaan diagnostik (p > 0,05) dan kepatuhan terapi (p > 0,05) dengan lama rawat inap pasien (gabungan = p > 0,05).

Kesimpulan: Banyak faktor yang dapat dikaikat dengan lama rawat inap terutama kondisi pasien itu sendiri. Dalam penelitian ini, kepatuhan alur klinis tidak berdampak dalam mengurangi lama rawat inap.

Kata kunci: alur klinis, anak-anak, kepatuhan, lama rawat inap.

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INTRODUCTION

Clinical pathway is multidisciplinary care plan based on the best clinical practice for a group of patients with a particular diagnosis, designed to minimize care delay, optimize resource utilization, and maximize the quality of care, as well as clinical outcomes (Aniza et al., 2016; Fujino et al., 2014; Li et al., 2014; Kaiser et al., 2018; Aspland et al., 2019). Clinical pathway (CPW) is originally developed in the United States, Australia and the United Kingdom as a way to increase efficiency and reduce clinical costs (Mammen, Matsell and Lemley, 2013). Li et al. (2014) stated that concept of clinical pathway was introduced for the first time at the New England Medical Center (Boston, U.S.A) in 1985, originally by Karen Zander and Kathleen Bower. It arose following the introduction of diagnosis-related groups (DRG), the first widespread system of diagnostic classification underlying bundled payment for episodes of care (Mammen, Matsell and Lemley, 2013). Clinical pathway is already used in hospitals and various healthcare organizations in many parts of the world, including in Asia (Aniza et al., 2016). Clinical pathway is used as audit, re-audit tools and quality assurance (Wetherill et al., 2016).

Clinical pathway is known as ‘care pathway’, ‘critical pathway’, ‘integrated care pathway’ and ‘care map’ (Aspland et al., 2019). Many criteria can be used to determine whether it is clinical pathway or not. The first one is structured multidisciplinary plan of care (Aspland et al., 2019). Such plan of care is designed based on the existing clinical guideline or clinical evidence (Aspland et al., 2019). The existing clinical guideline or clinical evidence should be reviewed and adjusted as well as the specifics of the local environment and the realities of local practice to be formed as clinical pathway (Buchert and Butler, 2016). Clinical pathway is linked with evidence to practice and optimize clinical outcomes while maximizing clinical efficiency (Fujino et al., 2014). Clinical pathway can be made by adapting the documents used in hospitals known as Standard Operating Procedures that aims to improve efficiency of services given by healthcare workers (Li et al., 2014; Aspland et al., 2019; Zhang et al., 2014). Guidelines and evidence-based practice need to be combined with best practice rules so it can produce good clinical pathways (Kolk et al., 2017). Furthermore, the last one, which is plan of care details the steps in a course of treatment or care and it has time frames for every treatment stated (Aspland et al., 2019).

A clinical pathway is a standard of care delivery that begins with assessment, diagnosis, information support, rehabilitation, and clinical audit (Asmirajanti et al., 2018). The pathway can also help to identify the critical components impeding patient care or supporting facilities. Clinical pathway concentrates on 3 dimensions, diagnosis which means patients’ disease, treatment which means the manner of patients’ treated medically or surgically, and prevention which means to avoid an injury or disease (Mater and Ibrahim, 2014). Clinical pathway provides a guidance for every diagnostic examination and therapy that doctor needs to provide (Mammen, Matsell and Lemley, 2013). Right choice of diagnostic examination and therapy could improve clinical outcome for patients. That is one of the reasons for hospitals to implement clinical pathway. However, clinical pathway should not be viewed as “cookbook” for healthcare with prescriptive of step-by-step instructions, but rather as a set of evidence-based activities and interventions developed for a specific user group.

The important thing for successful interprofessional collaboration is which is
carried out continuously between the health care team and patients (Asmirajanti et al., 2018). The implementation of clinical pathway needs collaboration between doctors, nurses, and other health care professionals. Clinical pathway is used as media for communication among the health care team and patients (Mammen, Matsell and Lemley, 2013). The pathway should clearly delineate the elements of care specific to each discipline or role, such that there is a structured plan of care to be enacted by each member of the health care team (Buchert and Butler, 2016). Effective communication is a key in implementing interprofessional collaboration to improve the quality of health services (Asmirajanti et al., 2018). Interprofessional collaboration must be implemented transparently and evaluated continuously by the management of health.

Implementation of clinical pathway has direct effect on health service quality and patient safety (Buchert and Butler, 2016). Health service quality can be improved by implementing clinical pathway (Mater and Ibrahim, 2014). Lower complication in some cases of diseases can be occurred when clinical pathway is implemented in hospitals (Aniza et al., 2016). The implementation of clinical pathway can reduce readmission rates, health service cost (Buchert and Butler, 2016) and even increase the patients' satisfaction (Wetherill et al., 2016; Cudre et al., 2016). Patients feel satisfied and safe because doctors can explain the detail of every care given to patient as stated in clinical pathway (Cudre et al., 2016). Patients’ safety can be improved by implementing clinical pathway too (Asmirajanti et al., 2018). Implementing clinical pathway can reduce the incidence of healthcare associated infection because clinical pathway implementation can reduce patients’ length of stay (Asmirajanti et al., 2018). Furthermore, clinical pathway can improve internal hospital efficiency and effectiveness (Mater and Ibrahim, 2014).

Length of stay is one of the outcome indicators used to evaluate the effects of clinical pathway (Bai et al., 2018). Hospital cost and complications could be used to measure the cost effectiveness of clinical pathway. Length of stay can be reduced when hospital implements clinical pathway for example in stroke patients (Fujino et al., 2014). Prolonged hospitalization often accompanied by healthcare associated infections (Haque et al., 2018; Elliott and Justiz-vailant, 2018). The term of healthcare associated infections initially referred to those infections linked with admission to an acute-care hospital (earlier called nosocomial infections) and now includes infections developed in various settings where patients obtain health care (e.g., long-term care, family medicine clinics, home care, and ambulatory care). Healthcare associated infection is related to extra cost for patient and can prolong the length of stay too (Schmier et al., 2016; Baek et al., 2018).

A retrospective cohort study found that compliance to clinical pathway is associated with length of stay and cost of services (Bryan et al., 2019). In that research, they tried to evaluate the effect of compliance to standard clinical pathway on health care use and costs in the pediatric emergency department and inpatient settings. The result was the higher the compliance to the clinical pathway, the lower the health service cost and shorter length of stay. Diagnostic examination and therapy compliance are included in criteria of compliance to the clinical pathway.

In one of private hospitals in Surabaya, the average length of stay for pediatric acute gastroenteritis cases at 2017 was more than 5 days. The length of stay kept increasing every month as stated in Figure 1. Data showed in Figure 1 were collected from audit data done by clinical
pathways’ team in hospital. It was longer than the average length of stay for pediatric acute gastroenteritis cases in 2016 which was 4 days. The average length of stay for acute gastroenteritis for pediatric patients is stated as prolonged if the length of stay is more than 4 days (Guarino et al., 2014). This study aimed to determine diagnostic examination and therapy compliance of clinical pathway related to length of stay. If compliance of clinical pathway is related to length of stay, it will be easier to decide what step must be chosen by hospital management and medical board to interfere the clinicians’ compliance.

Figure 1. Average Length of Stay for Acute Gastroenteritis Pediatric in 2017.

METHOD

This study was observational cross-sectional research. This study was conducted in one of private hospitals at Surabaya during September-October 2019. The population was all pediatric patients who were admitted during January to December 2018 with acute gastroenteritis. The age range for pediatric patients is 1 month until 15 years old. There were 455 cases admitted as inclusion criteria for that period.

Researchers calculated the sample that need to be collected by using this following formula (Hulley et al., p.79). From that formula, the minimal sample for this research was 194 cases. Researchers used simple random sampling to get the sample for this research. The independent variables were diagnostic examination compliance, therapy compliance and for dependent variable was length of stay in this study. The hypothesis in this study was that diagnostic examination compliance and therapy compliance have an effect in reducing length of stay.

\[ n = \left[ \frac{Z_\alpha + Z_\beta}{\frac{1}{2} \ln \left( \frac{1 + \rho}{1 - \rho} \right)} \right]^2 + 3 \]

\( Z_\alpha = \) the standard normal deviation for two sided \( \alpha \) (\( \alpha = 0.05 \))

\( Z_\beta = \) the standard normal deviation for \( \beta \) (\( \beta = 0.20 \))

\( \rho = \) expected coefficient correlation

Researchers collected data from clinical pathways form that was filled by doctors, nurses and other health care professionals at medical records department. There were 10 pediatricians evaluated in filling clinical pathways. The inclusion criteria were every case admitted as acute gastroenteritis during January till December 2018 and clinical pathway forms were filled completely by doctors, nurses and other health care professionals. Forms which were not completely filled must be excluded because it was hard to be assessed whether every diagnostic stated in clinical pathway were done by doctors or not. There were 18 cases excluded from 215 cases collected because those forms were not filled completely even by doctors, nurses and other health care professionals. Researchers collected data of diagnostic examination and therapy compliance from the clinical pathway form. Researchers did not collect personal data and medical records number in this research. Researchers renamed every patient with...
alphabetical code, such as A, B, C, …. This study obtained ethical approval from the Ethics Committee of the Faculty of Public Health of Universitas Airlangga with the ethics code of 617-KEPK.

Researchers measured the compliance by checking every diagnostic examination and therapy that was given to the patient and compared it with the standards of diagnostic examination and therapy stated in the form. If there was one or more diagnostic examination or therapy that was not stated in the form, that cases would be categorized as no compliance and vice versa. Researchers calculated the length of stay for every case by reducing the time patient admitted to the hospital with the time patient finished their treatment and administration in the hospital.

After the data were collected, researchers analyzed the data using correlation statistical analysis. The data collected from diagnostic examination and therapy compliance were nominal data. The compliance was stated as 1 and no compliance was stated as 0 for the data. The length of stay was continuous data. Researchers did not include the medical records number and patients’ data in our inputted data. Researchers did descriptive statistical analysis for every variable then researchers proceed with statistical analysis. Multiple classification analysis, non-parametric statistical analysis was done to determine the relationship between diagnostic examination and therapy compliance with length of stay. The descriptive and correlation statistical analysis were done by SPSS 25.

RESULTS AND DISCUSSION

There were 197 patients with clinical pathway filled completely. After data collection was done, there were 60.91% of cases were complied with the diagnostic examination as stated in clinical pathway. The compliance for diagnostic were lower than the therapy compliance which was 88.32%. The compliance data were shown in Table 1.

Table 1. Diagnostic Examination and Therapy Compliance in the Period of January-December 2018.

| Month   | Compliance of Diagnose | | | Compliance of Therapy | | |
|---------|------------------------|---|---|------------------------|---|
|         | Yes | %  | No | %  | Yes | %  | No | %  |
| January | 15  | 57.69 | 11 | 42.31 | 26 | 100.00 | 0 | 0.00 |
| February| 14  | 63.64 | 8  | 36.36 | 18 | 81.82 | 4 | 18.18 |
| March   | 15  | 68.18 | 7  | 31.82 | 18 | 81.82 | 4 | 18.18 |
| April   | 7   | 53.85 | 6  | 46.15 | 10 | 76.92 | 3 | 23.08 |
| May     | 3   | 30.00 | 7  | 70.00 | 8  | 80.00 | 2 | 20.00 |
| June    | 2   | 16.67 | 10 | 83.33 | 10 | 83.33 | 2 | 16.67 |
| July    | 2   | 25.00 | 6  | 75.00 | 7  | 87.50 | 1 | 12.50 |
| August  | 7   | 41.18 | 10 | 58.82 | 17 | 100.00 | 0 | 0.00 |
| September| 3   | 75.00 | 1  | 25.00 | 3  | 75.00 | 1 | 25.00 |
| October | 21  | 87.50 | 3  | 12.50 | 23 | 95.83 | 1 | 4.17 |
| November| 19  | 73.08 | 7  | 26.92 | 21 | 80.77 | 5 | 19.23 |
| December| 12  | 92.31 | 1  | 7.69 | 13 | 100.00 | 0 | 0.00 |
| Total   | 120 | 60.91 | 77 | 39.09 | 174 | 88.32 | 23 | 11.68 |
The highest compliance for diagnostic examination can be found in December, while the lowest can be found in June 2018. The compliance for diagnostic compliance was never at 100%. It was so different if researchers compared it with therapy compliance. For three months at January, August and December, the compliance for therapy was 100%. The lowest percentage of therapy compliance can be found in September at 75.00%. Researchers can conclude that the compliance for therapy was better than diagnostic examination.

There was a standard set for length of stay of pediatric acute gastroenteritis which is 4 days. The standard was set from the analysis of average length of stay for acute gastroenteritis cases in pediatric at 2016. Every year, hospitals’ medical board reviews every standard, guidelines, clinical pathways, especially for average length of stay. In addition, in 2018, hospitals’ medical board decided that average length of stay for pediatric acute gastroenteritis was 4 days.

The collected data showed that there were many variations for length of stay. Descriptive analysis was done for length of stay and the data were shown in Table 2 and Table 3. The descriptive analysis data showed that average length of stay from diagnostic examination variable and therapy compliance variable were less than 4 days. They were less than the standard set for clinical pathway. There was no big difference between average length of stay for compliant cases and no compliant cases for diagnostic compliance variable and therapy compliance variable.

The length of stay for cases with no compliance at diagnostic examination was better than cases with compliance. It was so different if researchers compared to therapy compliance variable. Cases with compliance at therapy section were better than no compliance cases. Researchers found that maximum length of stay in this study was 7 days. From those descriptive data, researchers could make a conclusion that there was no association between diagnostic examination and therapy compliance with length of stay. This result was so different with the conclusion from another research done before. For bronchiolitis cases, the researcher found shorter length of stay in cases with higher compliance to the clinical pathway (Bryan et al., 2019).

Later, researchers did statistical analysis to determine the correlation between diagnostic examination and therapy compliance with the length of stay. Researchers used Multiple Classification Analysis and input the data into the formula in SPSS 25. The results of statistical analysis were shown in Table 4. The statistical analysis results showed conclusion similar to the results of descriptive analysis. There was no statistically significant correlation between diagnostic examination compliance of clinical pathway with patients’ length of stay (p > 0.05). Therapy compliance showed the same result for the statistical significance (p > 0.05). Even when diagnostic variable and therapy variable were combined and analyzed statistically, they showed the same result (combined = p > 0.05). The higher compliance of diagnostic examination and therapy did not have any effect on the length of stay in pediatric acute gastroenteritis cases. This result was the opposite of the study result by Bryan et al. (2019) and Kaiser et al. (2018).

In this cross-sectional study, researchers tried to examine the correlation between diagnostic examination compliance with the length of stay and therapy compliance with length of stay. There were some research projects showed that there was correlation between clinical pathway compliance and the length of stay. The compliance to the clinical
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pathway was related to the length of stay (Bryan et al., 2019). Bryan et al. conducted a retrospective cohort study to examine correlation between clinical pathway compliance with healthcare costs, length of stay and inpatient readmission. They used Pediatric Respiratory Illness Measurement System (PRIMES) quality indicator to determine the compliance score of clinical pathway. Diagnostic examination and therapy compliance were included in those indicators. In those research, they found shorter length of stay and lower cost in higher compliance score to the clinical pathway. It can be concluded that there was correlation between compliance to the clinical pathway with the length of stay and healthcare cost. However, in this study, researchers really considered that they were unable to control variables that may have affected the time of discharged. Researchers mentioned that parental anxiety can be one of the reasons for prolonged length of stay. Patients' comorbidity and illness severity were the variables that could not be controlled by researchers in their study, especially illness severity that could affect the length of stay.

Table 2. Descriptive Analysis Data for Length of Stay at Diagnostic Compliance Variable.

| Description                        | No Compliance | Comply |
|------------------------------------|---------------|--------|
|                                    | Statistic     | Std. Error | Statistic | Std. Error |
| LOS                                | 3.3506        | .11510 | 3.4083 | .07623 |
| 95% Confidence Interval for Mean   | 3.1214        | 3.2574 |
| Lower Bound                        |               |        |         |         |
| Upper Bound                        | 3.5799        | 3.5593 |
| 5% Trimmed Mean                    | 3.3052        | 3.3981 |
| Median                             | 3.0000        | 3.0000 |
| Variance                           | 1.020         | .697   |
| Std. Deviation                     | 1.01003       | .83511 |
| Minimum                            | 1.00          | 2.00   |
| Maximum                            | 7.00          | 5.00   |
| Range                              | 6.00          | 3.00   |
| Interquartile Range                | 1.00          | 1.00   |
| Skewness                           | .657          | .274  | -.100 | .221 |
| Kurtosis                           | 1.562         | .541  | -.610 | .438 |

The correlation between compliance to clinical pathways and length of stay was proven too in another research project. Compliance of clinical pathway can shorten the length of stay, reduce pain intensity, surgical site infection incidence and total real cost of caesarian section patients (Haninditya et al., 2019). This study was conducted at type C private hospital in Yogyakarta. The variables were analyzed by Chi square test and non-parametric regression test. All statistical test showed that there was correlation between clinical pathway compliance and all variables of patient outcomes (length of stay, pain intensity, surgical site infection incidence and total real cost of caesarian section). From this research, researchers concluded that compliance to clinical pathway is an important thing to decrease the length of stay and improve patients' clinical outcome. In this study, researchers stated that there
were some limitations. One of its limitations was that they could not control external factors such as physical factors of patient that can affect patient outcome especially their length of stay.

A multicenter cohort study was conducted to evaluate effectiveness of pediatric asthma clinical pathway for hospitalized children (Kaiser et al., 2018). They were using Pediatric Health Information system as their database. They used generalized estimating equations (GEEs) with an interrupted time series approach to determine the correlation between implementation of clinical pathway and study outcomes, especially length of stay. This study was different compared to another study especially for the time they conducted outcome analysis. Many studies did their evaluation for the outcome over a shorter time period of 6-12 months after the implementation. This study focused on longer-term sustained effects. The study result was as they expected that there was a correlation between clinical pathway compliance and the length of stay. They found that the reduced length of stay in existing clinical pathway implementation was greater than new version of clinical pathway implementation.

### Table 3. Descriptive Analysis Data for Length of Stay at Therapy Compliance Variable.

| Description                              | Therapy Compliance | No Compliance | Comply |
|------------------------------------------|--------------------|---------------|--------|
|                                          | Statistic         | Std. Error    | Statistic | Std. Error |
| LOS Mean                                 | 3.3913            | .20603        | 3.3851  | .06800     |
| 95% Confidence Interval for Mean Lower   | 2.9640            |               | 3.2508  |            |
| Bound                                    |                   |               |         |            |
|                                         | 3.8186            |               | 3.5193  |            |
|                                         |                   |               |         |            |
| 5% Trimmed Mean                          | 3.3792            |               | 3.3595  |            |
| Median                                   | 3.0000            |               | 3.0000  |            |
| Variance                                 | .976              |               | .805    |            |
| Std. Deviation                           | .98807            |               | .89701  |            |
| Minimum                                  | 2.00              |               | 1.00    |            |
| Maximum                                  | 5.00              |               | 7.00    |            |
| Range                                    | 3.00              |               | 6.00    |            |
| Interquartile Range                      | 1.00              |               | 1.00    |            |
| Skewness                                 | .021              | .481          | .326    | .184       |
| Kurtosis                                 | -.944             | .935          | .934    | .366       |

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result was as they expected that there was a correlation between clinical pathway compliance and the length of stay. They found that the reduced length of stay in existing clinical pathway implementation was greater than new version of clinical pathway implementation.

Another research focused on compliance to antibiotic treatment proving that compliance was related to lower length of stay (Wathne et al., 2019). This study was observational cohort study conducted for five months across three university hospitals in Western Norway. This study was a multicenter study and it could increase generalizability for the results. They used national guidelines as their standard of antibiotics treatment. Chi square test and two-sample t-test were used to analyze the correlation between guideline adherent prescribing practice and patient outcome. The result was the same as Bryan et al. research, that length of stay was lower for guideline adherent group, compared to the non-adherent group.

Table 4. Correlation between Diagnostic Examination and Therapy Compliance with the Length of Stay.

| ANOVAa  | Hierarchical Method | Sum of Squares | Df | Mean Square | F  | Sig. |
|---------|---------------------|----------------|----|-------------|----|------|
| LOS     | Main Effects (Combined) | .162 | 2  | .081 | .098 | .907 |
|         | Diagnostic Examination Compliance | .156 | 1  | .156 | .188 | .665 |
|         | Therapy Compliance | .006 | 1  | .006 | .008 | .930 |
|         | 2-Way Interactions Diagnostic Examination Compliance Therapy Compliance | .114 | 1  | .114 | .137 | .711 |
| Model   |                      | .277 | 3  | .092 | .111 | .954 |
| Residual|                      | 160.404 | 193 | .831 |
| Total   |                      | 160.680 | 196 | .820 |

a. LOS by Diagnostic Examination Compliance, Therapy Compliance

A systematic review was conducted to review that clinical pathway guidelines was related to lower length of stay (Ellen et al., 2017). They conducted semi-structured interviews with staff from nine hospitals whose jobs dealt with developing, implementing, monitoring, updating, or evaluating clinical pathway guidelines. They showed that there were five main factors affecting the relationship between clinical pathway guidelines and length of stay. The factors were the purpose of implementation, evidence based for clinical pathway guidelines content and selection, health care professionals’ response to change and compliance, dissemination of strategies and organizational support and resources. The second main factor could be one of causes for unexpected result in this research. Researchers suggested that once a clinical pathway guideline is adopted, it needs to be evaluated and
updated regularly. Some participants on that research stated that while the organization requires annual or bi-annual review, it is not always done and is usually an ad hoc process. In this study, researchers stated same perception from the pediatrician that were observed in this study that clinical pathway forms need to be reviewed especially for the diagnostic part.

In this study, researchers found unexpected result. The study showed that there was no correlation between the clinical pathway compliance and length of stay. This result was the same as result presented by Lifland et al. (2018). They did the same research for different population to determine correlation between level of compliance with the length of stay, cost and readmissions (Lifland et al., 2018). The population was patients who were eligible for the Adolescent Depressive Disorders Clinical Pathway, admitted between January 1, 2014, and May 31, 2015 in pediatric tertiary care facility. The level of compliance was measured by comparing the processes of care with standard electronic form that was stored in an internal Psychiatry and Behavioral Medicine Unit (PBMU) database. The study findings showed that there was no association between levels of compliance and the length of stay. The higher the compliance level of clinical pathway, the longer the length of stay patient stays. In this study, the prolonged length of stay can occur because time is needed to complete every module of therapy for the patients. The clinician needed a longer length of stay because they need to finish a module to assess and treat the patient. Lifland et al. stated that the clinical pathway may improve another clinical outcome that were not measured in those study, such as inpatient readmission. However, in this study, acute gastroenteritis did not need time for the therapy completed as psychotherapy did in Liflands’ study.

There may be other factors that could affect this study result such as greater illness severity. This limitation could be found in Carson et al. (2017). Their research was prospective quality improvement project to implement clinical pathway for acute gastroenteritis in pediatric initiated by nurse. They compared two groups, with and without intervention and measured the resource reduction in this research. They found that there were statistically significantly lower rates of resources uses such as inappropriate intravenous fluid, laboratories studies and imaging studies. However, in this study, they still found prolonged length of stay in both groups. They stated that illness severity could had an impact for length of stay.

Although the finding of this study demonstrates that there was no correlation between clinical pathway compliance and length of stay, the clinical pathway compliance can improve the unmeasured outcomes in this study. Clinical pathway compliance can reduce mortality for inpatient (Opoka et al., 2019). They conducted this study to evaluate the relationship between clinical care factors especially clinical guideline adherence and inpatient deaths. The compliance was measured by the principles used in the development of Pediatric Admissions Quality of Care (PAQC) score. They showed that compliance to clinical guidelines reduced inpatient mortality in children with suspected SA by 72%. Reduced inpatient mortality associated with clinical guidelines compliance was stated by another researcher (Ahmed et al., 2017; Marincowitz et al., 2019; Komajda et al., 2017).

A retrospective cohort study showed that guideline compliance for serial evaluation in patients with asymptomatic severe aortic stenosis can reduce all-cause mortality (Ahmed et al., 2017). In this study,
there was no difference in age, race/ethnicity, sex, comorbidities, insurance status, left ventricular function, and aortic stenosis severity between patients with and patients without guideline adherence. Patients without compliance guideline had higher rates of death (hazard ratio [HR], 1.57; 95% CI, 1.07-2.30; \( P < .001 \)), myocardial infarction (HR, 1.87; 95% CI, 1.00-3.49; \( P = .04 \)), and stroke (HR, 1.94; 95% CI, 1.02-3.71; \( P = .04 \)). Patients with greater compliance group may benefit from early identification of indications for surgical intervention, which is well known to be a life-saving therapy for severe aortic stenosis. However, the limitation in this study was the nonrandomized sampling that can create bias to generalize the conclusion for population.

An interrupted time series analysis study was done to evaluate the effectiveness of the implementation of head injury guideline (Marincowitz et al., 2019). In this study, researchers used complete Office of National Statistics cause of death data linked to hospital episode statistics for inpatient admissions in England. Data analysis was stratified into specific age groups (0-15, 16-64 and 65+). The result showed that there was reduced mortality rates on the first and second group but not for third group. There was increased admission rates and mortality rates but they assured that those were not unaffected by implementation of guideline.

An international, prospective, observational, longitudinal survey was done in 36 countries to evaluate clinical guidelines for heart failure with reduced ejection fraction (Komajda et al., 2017). Patients that participated in surveys were followed up after 6 months to be evaluated their outcome. At 6-months follow-up, poor compliance was correlated to significantly higher overall mortality, increased cardiovascular mortality and heart failure mortality. It showed that there was a strong trend between poor compliance and heart failure hospitalization (HR 1.32, 95% CI 1.04–1.68, \( P=0.069 \)). However, researchers realized that the population for this study relatively young and may not represent the overall profile of heart failure in elderly patients.

There were many studies showed another outcome that could be evaluated for clinical pathway compliance. Researchers realized that there were some limitations in this study. This study needs further investigation especially for other clinical outcomes. Other clinical outcomes such as mortality rates, total health care cost and readmission rate can be measured in the next research. Other factor such as illness severity that could interfere the length of stay should be assessed and categorized. Another limitation in this study was the limited population. This study was conducted only at a single institution. It may limit the generalization of results. However, the institution used in this study was likely representative of another general hospital because of its amounts of patients and referrals. Researchers hope for next research can conduct study at more than 1 hospital and across another district. This study did not use validated tools to measure compliance of clinical pathway. However, this study proved that reviewing clinical pathways was an important thing to implement clinical pathway and to increase clinical pathway compliance.

CONCLUSION

Compliance of clinical pathway did not have any correlation with the length of stay especially for diagnostic examination and therapy compliance in this study. However, many factors can be related with length of stay especially patients’ condition itself. The content of clinical pathway form needs to be reviewed every year. This study contributes to the limited existing
literature about clinical pathway compliance related with its outcomes. Researchers hope for future studies should examine for another outcome related with clinical pathway compliance.

**CONFLICT OF INTEREST**

The authors state that there is no conflict of interest for this article.

**REFERENCES**

Ahmed, A. *et al.* (2017) 'Association of Guideline Adherence for Serial Evaluations With Survival and Adverse Clinical Events in Patients With Asymptomatic Severe Aortic Stenosis', *JAMA Cardiology*, 2(10), pp. 1141-1146.

Aniza, I. *et al.* (2016) 'Implementation of clinical pathways in Malaysia: Can clinical pathways improve the quality of care? Implementation of Clinical Pathways in Malaysia: Can Clinical Pathways Improve the Quality of Care?', *International Medical Journal*, 23(1), pp. 47-50.

Asmirajanti, M. *et al.* (2018) 'Clinical care pathway strengthens interprofessional collaboration and quality of health service: a literature review', *Enfermería Clínica*, 28(Supplement 1), pp. 240–244.

Aspland, E. *et al.* (2019) 'Clinical pathway modelling: a literature review Clinical pathway modelling: a literature review', *Health Systems*, pp. 1–23. doi: https://doi.org/10.1080/20476965.2019.1652547.

Baek, H. *et al.* (2018) 'Analysis of length of hospital stay using electronic health records: A statistical and data mining approach', *PloS one*, 13(4), pp. 1–16.

Bai, J. *et al.* (2018) 'The perceived and objectively measured effects of clinical pathways’ implementation on medical care in China', *PloS one*, 13(5), pp. 1–13.

Bryan, M. A., Desai, A. D. and Wilson, L. (2019) 'Association of Bronchiolitis Clinical Pathway Adherence With Length of Stay and Costs', *Pediatrics*, 139(3), pp. 1-8.

Buchert, A. R. and Butler, G. A. (2016) 'Clinical pathways: driving high-reliability and high-value care', *Pediatric Clinics*, 63(2), pp. 317–328. doi: http://dx.doi.org/10.1016/j.pcl.2015.12.005.

Carson, R. A., *et al.* (2017) 'Evaluation of a nurse-initiated acute gastroenteritis pathway in the pediatric emergency department', *Journal of Emergency Nursing*, 43(5), pp. 406-412.

Cudre, L. *et al.* (2016) 'Implementation of a visceral surgery clinical pathway: Evaluating patient satisfaction with information, safety and involvement in care', *International Journal of Care Coordination*, 18(4), pp. 93–99.

Ellen, M., Baker, G. R. and Brown, A. (2017) 'The impact of acute care clinical practice guidelines on length of stay: A closer look at some conflicting findings', *Journal of Hospital Administration*, 3(4), pp. 25-36.

Elliott, C. and Justiz-vailant, A. (2018) 'Nosocomial Infections: A 360-degree Review', *International Biological and Biomedical Journal*, 4(2), pp. 72-81.

Fujino, Y. *et al.* (2014) 'Impact of Regional Clinical Pathways on the Length of Stay in Hospital Among Stroke Patients in Japan', *Medical care*, 52(7), pp. 634–640.

Guarino, A. *et al.* (2014) 'European Society for Pediatric Gastroenterology, Hepatology, and Nutrition/European Society for Pediatric Infectious Diseases evidence-based guidelines...
for the management of acute gastroenteritis in children in Europe: update 2014', *Journal of pediatric gastroenterology and nutrition*, 59(1), pp. 132-152.

Haninditya, B. *et al.* (2019) 'Analisis Kepatuhan Pelaksanaan Clinical Pathway Sesarea di Sebuah Rumah Sakit Swasta di Yogyakarta Seksi', *Jurnal Manajemen Dan Pelayanan Farmasi*, 9(1), pp. 38–45.

Haque, M. *et al.* (2018) 'Health care-associated infections – an overview', *Infection and drug resistance*, 11, pp. 2321–2333.

Hulley, S. B. *et al.* (2013) *Designing Clinical Research. 4th edn*. Philadelphia: Lippincott William & Wilkins.

Kaiser, S. V. *et al.* (2018) 'Effectiveness of Pediatric Asthma Pathways for Hospitalized Children', *The Journal of Pediatrics*, 197, pp. 165-171. doi: https://doi.org/10.1016/j.jpeds.2018.01.084.

Kolk, M. van der *et al.* (2017) 'Implementation and Evaluation of a Clinical Pathway for Pancreaticoduodenectomy Procedures: a Prospective Cohort Study', *Journal of Gastrointestinal Surgery*, 21, pp. 1428–1441.

Komajda, M. *et al.* (2017) 'Physicians’ guideline adherence is associated with better prognosis in outpatients with heart failure with reduced ejection fraction: the QUALIFY international registry', *European journal of heart failure*, 19, pp. 1414 – 1423.

Li, W. *et al.* (2014) 'Integrated clinical pathway management for medical quality improvement – based on a semiotically inspired systems architecture', *European Journal of Information Systems*, 23, pp. 400–417.

Lifland, B. *et al.* (2018) 'The Impact of an Adolescent Depressive Disorders Clinical Pathway on Healthcare Utilization', *Administration and Policy in Mental Health and Mental Health Services Research*, 45(6), pp. 979-987. doi: http://dx.doi.org/10.1007/s10488-018-0878-6.

Mammen, C., Matsell, D. G. and Lemley, K. V (2013) 'The importance of clinical pathways and protocols in pediatric nephrology', *Pediatric Nephrology*, 29(10), pp. 1903-1914.

Marincowitz, C. *et al.* (2019) 'Evaluation of the impact of the NICE head injury guidelines on inpatient mortality from traumatic brain injury: an interrupted time series analysis', *BMJ open*, 9(e028912), pp. 1-9.

Mater, W. and Ibrahim, R. (2014) 'Delivering Quality Healthcare Services using Clinical Pathways', *International Journal of Computer Applications*, 95(1), pp. 5–8.

Opoka, R. O. *et al.* (2019) 'Adherence to clinical guidelines is associated with reduced inpatient mortality among children with severe anemia in Ugandan hospitals', *PloS one*, 14(1), pp. 1–15.

Schmier, J. K. *et al.* (2016) 'Estimated hospital costs associated with preventable health care-associated infections if health care antiseptic products were unavailable', *Clinico Economics and Outcomes Research*, 8, pp. 197–205.

Wathne, J. S. *et al.* (2019) 'The association between adherence to national antibiotic guidelines and mortality, readmission and length of stay in hospital inpatients: results from a Norwegian multicentre, observational cohort study', *Antimicrobial Resistance & Infection Control*, 8(63), pp. 1–10.
Implementation of a care pathway for infantile hypertrophic pyloric stenosis reduces length of stay and increases parent satisfaction', *International Journal of Care Coordination*, 18(4), pp. 78–84.

Zhang, M. et al. (2014) 'The application of clinical pathways in laparoscopic cholecystectomy', *Hepatobiliary & Pancreatic Diseases International*, 13(4), pp. 348–353. doi: http://dx.doi.org/10.1016/S1499-3872(14)60279-4.