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**ORIGINAL RESEARCH**

# THE EFFECT OF CLINICAL PATHWAY COMPLIANCE ON REDUCING LENGTH OF STAY

*Pengaruh Kepatuhan Alur Klinis Dalam Menurunkan Lama Rawat Inap*

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**ABSTRACT**

**Background:** A clinical pathway is a multidisciplinary care plan based on the best clinical practice for a group of patients with a particular diagnosis designed to minimize care delay and maximize the quality of care and clinical outcomes. In 2017, the average length of stay for pediatric patients with acute gastroenteritis was prolonged even though clinical pathways had been implemented.
**Aim:** This study aims to determine the relation between the diagnostic examination and therapy compliance of the clinical pathway related to the length of stay.
**Method:** This study was cross-sectional research utilizing simple random sampling. Researchers analyzed pediatric patients whose clinical pathway was fully completed by doctors. The inclusion criteria were pediatric patients admitted to hospitals between January and December 2018 as acute gastroenteritis patients. The data were analyzed using multiple classification analysis.
**Results:** There were 197 patients whose clinical pathway was fully completed. In total, 60.91% of cases were compiled 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 the clinical pathway and patients' length of stay (combined = $p > 0.05$).
**Conclusion:** Many factors could be related to the length of stay, especially patients' condition. In this study, clinical pathway compliance had no impact on 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 diisi 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 dikaitkan 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.*

## INTRODUCTION

A clinical pathway (CPW) is a 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

and clinical outcomes (Aspland *et al.,* 2019; Kaiser *et al.,* 2018; Aniza *et al.,* 2016; Li *et al.,* 2014; Fujino *et al., et al.,*2014*et al.,et al.,*). The CPW was 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 the concept of the CPW was introduced for the first time at the New England Medical Center (Boston, U.S.A) in 1985 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). The CPW is utilized in hospitals and various healthcare organizations in many parts of the world, including Asia (Aniza *et al.,* 2016). It is utilized as an audit and re-audit tool and for quality assurance (Wetherill *et al.,* 2016).

A CPW is also known as a "care pathway", "critical pathway", "integrated care pathway" and "care map" (Aspland *et al.,* 2019). Many criteria can be utilized to determine whether it is CPW or not. The first criterion is a structured multidisciplinary plan of care (Aspland *et al.,* 2019). Such a 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, and the specifics of the local environment and the realities of local practice should be formed as the CPW (Buchert and Butler, 2016). The CPW is linked with evidence to practice and optimize clinical outcomes while maximizing clinical efficiency (Fujino *et al.,* 2014). A CPW can be created by adapting the documents utilized in hospitals known as Standard Operating Procedures that aim to improve the efficiency of services provided by health care workers (*et al.,*Aspland *et al.,* 2019; Li *et al.,* 2014;

Zhang *et al.,* 2014). Guidelines and evidence-based practice need to be combined with best practice rules to produce good CPWs (Kolk *et al.,* 2017). The plan of care details the steps in a course of treatment or care and includes time frames for every treatment stated (Aspland *et al.,* 2019).

A CPW is a standard of care delivery that includes assessment, diagnosis, information support, rehabilitation, and clinical audit (Asmirajanti *et al.,* 2018). It can help identify the critical components impeding patient care or supporting facilities. A CPW concentrates on three dimensions: diagnosis, which means patients' disease; treatment, which means the manner in which patients are treated—whether medically or surgically; and prevention, which means to avoid an injury or disease (Mater and Ibrahim, 2014). A CPW provides guidance for every diagnostic examination and therapy that a doctor needs to provide (Mammen, Matsell and Lemley, 2013). The right choice of diagnostic examination and therapy could improve clinical outcomes for patients. This is one of the reasons for hospitals to implement the CPW. However, the CPW should not be viewed as a "cookbook" for health care with prescriptive step-by-step instructions, but rather as a set of evidence-based activities and interventions developed for a specific user group.

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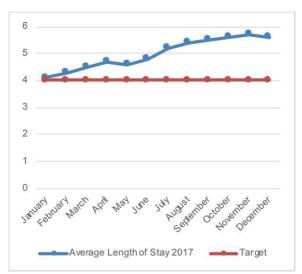
that there is a structured plan of care to be enacted by each member of the health care team (Buchert and Butler, 2016). Effective communication is a key in implementing interprofessional collaboration to improve the quality of health services (Asmirajanti *et al.,* 2018). Interprofessional collaboration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

Implementation of the CPW has a direct effect on health service quality and patient safety (Buchert and Butler, 2016). Health service quality can be improved by implementing a CPW (Mater and Ibrahim, 2014). Fewer complications can occur in some cases of diseases when a CPW is implemented in hospitals (Aniza *et al.,* 2016). The implementation of a CPW can reduce readmission rates and health service costs (Buchert and Butler, 2016), and even increase the patients' satisfaction (Cudre *et al.,* 2016; Wetherill *et al., et al.,*2016). Patients feel satisfied and safe as doctors can explain the details of care given to patients as stated in the CPW (Cudre *et al.,* 2016). Patients' safety can also be improved by implementing a CPW (Asmirajanti *et al.,* 2018). Implementing a CPW can reduce the incidence of health care-associated infection since it can reduce patients' length of stay (Asmirajanti *et al.,* 2018). Furthermore, a CPW can improve internal hospital efficiency and effectiveness (Mater and Ibrahim, 2014).

Length of stay is one of the outcome indicators utilized to evaluate the effects of a CPW (Bai *et al.,* 2018). Hospital costs and complications could be utilized to measure the cost-effectiveness of the CPW. Length of stay can be reduced when hospitals implements a CPW, for example, in stroke patients (Fujino *et al.,* 2014). Prolonged hospitalization is often accompanied by health care-associated infections (*et al.,*Elliott and Justiz-Vaillant, 2018; Haque *et al.,* 2018). The term health care-

associated infections initially referred to infections linked with admission to an acute-care hospital (previously called nosocomial infections); however, it 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). Health care-associated infection leads to extra costs for patients and can prolong the length of stay (Baek *et al.,* 2018; Schmier *et al.,* 2016*et al.,*).

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



Source: Audit Data of One Private Hospital in Surabaya in 2017
Figure 1. Average Length of Stay for Acute Gastroenteritis Pediatric Patients in 2017

In one of the private hospitals in Surabaya, the average length of stay for pediatric acute gastroenteritis cases in

2017 was more than 5 days. The length of stay continued to increase every month, as shown in Figure 1. Data shown in Figure 1 were collected from audit data collected by the CPW team in the hospital. The data show that the length of stay 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 pediatric patients is described as prolonged if the length of stay is more than 4 days (Guarino *et al.,* 2014). This study aimed to determine the diagnostic examination compliance and therapy compliance with the CPW related to length of stay. If compliance with the CPW is related to length of stay, it will be easier to decide what steps must be taken by the hospital management and medical board to improve the clinicians' compliance.

**METHODS**

This study was observational cross-sectional research. It was conducted in one of the private hospitals in Surabaya in September and October 2019. The population was pediatric patients who were admitted between January and December 2018 with acute gastroenteritis. The age range for pediatric patients was 1 month to 15 years. Following the inclusion criteria, 455 cases were admitted during that period.

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

$Z\alpha$ = the standard normal deviation for two-tailed $\alpha$ ($\alpha$ = 0.05)
$Z\beta$ = the standard normal deviation for $\beta$ ($\beta$ = 0.20)
$\rho$ = expected coefficient correlation.

Researchers calculated the sample that needed to be collected by utilizing Hulley et al.'s formula (Hulley *et al.,* 2013). According to this formula, the minimal sample for this research was 194 cases. Researchers utilized simple random sampling to obtain the sample for this research. In this study, the independent variables were diagnostic examination compliance and therapy compliance, and the dependent variable was length of stay. The hypothesis in this study was that diagnostic examination compliance and therapy compliance have an effect on reducing length of stay.

Researchers collected data from CPW forms that were completed by doctors, nurses and other health care professionals in the medical records department. Ten pediatricians were evaluated on completing CPWs. The inclusion criteria were every case admitted with acute gastroenteritis between January and December 2018 and the CPW forms were completed fully by doctors, nurses and other health care professionals. Forms that were not completed fully were excluded since it was difficult to determine whether every diagnostic examination stated on the CPW form was performed by doctors or not. Of the 215 cases collected, 18 cases were excluded as the forms were not completed fully by doctors, nurses, and other health care professionals. Researchers collected data on diagnostic examination compliance and therapy compliance from the CPW forms. Researchers did not collect personal data and medical record numbers in this research. Researchers renamed every patient with an alphabetical code, such as A, B, C. Ethical approval for this study was obtained from the Ethics Committee of the Faculty of Public Health of Universitas Airlangga with the ethics code 617-KEPK.

Researchers measured the compliance by checking all diagnostic examinations and therapy that were given to the patient and compared it with the standards of diagnostic examination and therapy stated on the form. If one or more

diagnostic examination or therapy was not stated on the form, the case/s would be categorized as no compliance, and vice versa. Researchers calculated the length of stay for every case by substracting duration at the time the patient was admitted to the hospital with duration of their treatment and administration at the hospital.

After the data were collected, researchers analyzed the data utilizing correlation analysis. The data collected on diagnostic examination compliance and therapy compliance were nominal data. 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 record numbers and patients' data in the inputted data. Researchers performed descriptive statistical analysis for every variable, and then proceeded with the statistical analysis. Multiple classification analysis, non-parametric statistical analysis, was performed to determine the relationship between diagnostic examination compliance and therapy compliance and length of stay. The descriptive and correlation statistical analyses were performed utilizing SPSS 25.

## RESULTS AND DISCUSSION

There were 197 patients whose CPW form was completed fully. After the data were collected, it was found that 60.91% of cases complied with the diagnostic examination as stated in the CPW form. The compliance for diagnostic tests was lower than the therapy compliance, which was 88.32%. The compliance data are shown in Table 1.

Table 1. Diagnostic Examination Compliance and Therapy Compliance during the Period January–December 2018

| Month | Compliance of Diagnostic Examination | | | | Compliance of Therapy | | | |
|---|---|---|---|---|---|---|---|---|
| | Yes | | No | | Yes | | No | |
| | n | % | n | % | n | % | n | % |
| 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. The diagnostic examination compliance was never 100%. This result was different to the therapy compliance

result. In January, August and December, the compliance for therapy was 100%. The lowest percentage for therapy compliance can be found in September at 75.00%. Researchers can therefore conclude that the compliance for therapy was better than that for diagnostic examination.

A standard was set for length of stay for pediatric acute gastroenteritis, which is 4 days. The standard was set from the analysis of the average length of stay for acute gastroenteritis cases in pediatric patients in 2016. Every year, the hospitals' medical board reviews all standards, guidelines, and CPWs, especially for average length of stay. In addition, in 2018, the hospitals' medical board decided that the average length of stay for pediatric acute gastroenteritis was 4 days.

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

The length of stay for cases with no compliance in diagnostic examination was better than cases with compliance. However, it was different if researchers compared it with the therapy compliance variable. Cases that complied with therapy were better than those without compliance. Researchers found that the maximum length of stay in this study was 7 days. From the descriptive data, researchers could conclude that there was no association between diagnostic examination compliance and therapy

compliance and length of stay. This result was different to the conclusion of a previous study. For bronchiolitis cases, researchers found a shorter length of stay in cases with higher compliance with the CPW (Bryan *et al.,* 2019).

Later, researchers performed statistical analysis to determine the correlation between diagnostic examination compliance and therapy compliance and length of stay. Researchers used multiple classification analysis and inputted the data into the formula in SPSS 25. The results of the statistical analysis are shown in Table 4. The statistical analysis results were similar to the results of the descriptive analysis. There was no statistically significant correlation between diagnostic examination compliance of the CPW with patients' length of stay ($p > 0.05$). Therapy compliance showed the same result for the statistical significance ($p > 0.05$). Even when the diagnostic examination variable and the 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 result in the studies of Kaiser et al. (2018) and Bryan et al. (2019).

In this cross-sectional study, researchers aimed to examine the correlation between diagnostic examination compliance and length of stay and between therapy compliance and length of stay. Some research projects showed that there was correlation between CPW compliance and length of stay. Compliance with the CPW was related to length of stay (Bryan *et al.,* 2019). Bryan et al. conducted a retrospective cohort study to examine the correlation between CPW compliance and healthcare costs, length of stay, and inpatient readmission. They utilized the Pediatric Respiratory Illness Measurement

System (PRIMES) quality indicator to determine the compliance score of the CPW. Diagnostic examination compliance and therapy compliance were included in those indicators. In this research, they found shorter length of stay and lower cost for higher compliance with the CPW. It can be concluded that there was correlation between compliance with the CPW and length of stay and health care cost. However, in this study, researchers stated that they were unable to control variables that may have affected the time of discharge. Researchers suggested 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, which could affect the length of stay.

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

| Description | | | No Compliance | | Compliance | |
|---|---|---|---|---|---|---|
| | Diagnostic Compliance | | Statistic | Std. Error | Statistic | Std. Error |
| Length of stay | Mean | | 3.3506 | .11510 | 3.4083 | .07623 |
| | 95% Confidence Interval (CI) for Mean | Lower Bound | 3.1214 | | 3.2574 | |
| | | 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 with the CPW and length of stay was proven in another research project. Compliance with the CPW can reduce the length of stay, pain intensity, surgical site infection incidence, and total real cost of caesarian section patients (Haninditya *et al.,* 2019). This study was conducted at a type C private hospital in Yogyakarta. The variables were analyzed by a Chi square test and non-parametric regression test. All the statistical tests showed that there was correlation between CPW 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 with the CPW is important to reduce the length of stay and improve patients' clinical outcome. In this study, researchers stated that there were some limitations. One of the limitations was that they could not control external factors such as physical factors of patients that can affect patients' outcome, especially their length of stay.

A multicenter cohort study was conducted to evaluate the effectiveness of

the pediatric asthma CPW for hospitalized children (Kaiser *et al.,* 2018). Researchers utilized the Pediatric Health Information system as their database. They utilized generalized estimating equations (GEEs) with an interrupted time series approach to determine the correlation between implementation of the CPW and patients' outcome, especially length of stay. This study was different to another study, especially in terms of the time period when they conducted the outcome analysis.

Many studies performed 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 researchers expected, that there was a correlation between CPW compliance and length of stay. They found that the reduced length of stay in the existing CPW implementation was greater than in the new version of CPW implementation.

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

| Description | | | | | | |
|---|---|---|---|---|---|---|
| | **Therapy Compliance** | | **No Compliance** | | **Comply** | |
| | | | **Statistic** | **Std. Error** | **Statistic** | **Std. Error** |
| LOS | Mean | | 3.3913 | .20603 | 3.3851 | .06800 |
| | 95% CI for Mean | Lower Bound | 2.9640 | | 3.2508 | |
| | | Upper 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 |

Another research study focused on compliance with antibiotic treatment and proved that compliance was related to shorter length of stay (Wathne *et al.,* 2019). This study was an observational cohort study conducted for five months across three university hospitals in Western Norway. It was a multicenter study, which could increase the generalizability of the results. Researchers utilized national guidelines as their standard for antibiotics treatment. A Chi square test and a two-sample t-test were utilized to analyze the correlation between guideline-adherent prescribing practice and patient outcome. The result was the same as that of Bryan et al.'s research that length of stay was shorter for the guideline-adherent group than the non-adherent group.

Table 4. Correlation between Diagnostic Examination Compliance and Therapy Compliance and 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 | | |

*Notes: Length Of Stay (LOS) by diagnostic examination compliance and therapy compliance*

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

In this study, researchers found an unexpected result. The study showed that there was no correlation between CPW compliance and length of stay. This result was the same as that obtained by Lifland et al. (2018). They conducted the same research on a different population to determine the correlation between level of compliance and 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 to a pediatric tertiary care facility between January 1, 2014, and May 31, 2015. The level of compliance was measured by comparing the processes of care with the 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 level of compliance and length of stay. The higher the compliance level with the CPW, the longer the patient stays. In this study, the prolonged length of stay could have occurred as time is needed to complete every module of therapy for the patients. The clinician needed a longer length of stay since they needed to finish a module to assess and treat the patient. Lifland et al. stated that the CPW may improve another clinical outcome that was not measured in those studies, such as inpatient readmission. However, in this study, acute gastroenteritis did not need time for the therapy to completed, unlike Lifland et al.'s study where psychotherapy needed to be completed.

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

Although the finding of this study demonstrates that there was no correlation between CPW compliance and length of stay, CWP compliance can improve the unmeasured outcomes in this study. CPW compliance can reduce mortality for inpatients (Opoka *et al.,* 2019). Researchers 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 the Pediatric Admissions Quality of Care (PAQC) score. Researchers showed that compliance with clinical guidelines reduced inpatient mortality in children with suspected SA by 72%. Reduced inpatient mortality associated with compliance with clinical guidelines was found by other researchers (*et al.,*Marincowitz *et al.,* 2019; Ahmed *et al.,* 2017; 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 compliance. Patients without guideline compliance had higher rates of death (hazard ratio [HR], 1.57; 95% CI, 1.07–2.30; $p < 0.001$), myocardial infarction (HR, 1.87; 95% CI, 1.00–3.49; $p = 0.04$), and stroke (HR, 1.94; 95% CI, 1.02–3.71; $p = 0.04$). Patients with greater compliance 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 of this study was the nonrandomized sampling, which can create bias in generalizing the conclusion to the population.

An interrupted time series analysis study was conducted to evaluate the effectiveness of the implementation of head injury guidelines (Marincowitz *et al.,* 2019). In this study, researchers utilized complete Office of National Statistics cause of death data linked to hospital episode statistics for inpatient admissions in England. The data analysis was stratified into specific age groups (0–15 years, 16–64 years, and 65+

years). The result showed that there were reduced mortality rates for the first and second groups but not for the third group. There were increased admission rates and mortality rates, but researchers assured that those were unaffected by implementation of the guidelines.

An international, prospective, observational, longitudinal survey was conducted in 36 countries to evaluate clinical guidelines for heart failure with reduced ejection fraction (Komajda *et al.,* 2017). Patients who participated in surveys were followed up after 6 months for their outcome to be evaluated. At the 6-month follow-up, poor compliance was correlated with significantly higher overall mortality, increased cardiovascular mortality, and heart failure mortality. It showed that there was a strong correlation 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 were relatively young and may not represent the overall profile of heart failure in elderly patients.

Many studies showed another outcome that could be evaluated for CPW compliance. Researchers realized that there were some limitations in this study. Therefore, further investigation is required, especially for other clinical outcomes. Other clinical outcomes such as mortality rates, total health care cost and readmission rate could be measured in the future research. Other factors such as illness severity that could affect the length of stay should be assessed and categorized. Another limitation of this study was the limited population. This study was conducted only at a single institution, which may limit the generalization of results. However, the institution utilized in this study was probably representative of another general hospital because of the number of patients and referrals. Researchers hope that the next research study can be conducted at more

than one hospital and across another district. This study did not utilize validated tools to measure compliance with CPW. However, it proved that reviewing CPWs was important when implementing a CPW to increase CPW compliance.

## CONCLUSION

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

## CONFLICT OF INTEREST

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

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