

Impact of a Clinical Pathway for Pediatric Uncomplicated Acute Appendicitis

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Abstract

Purpose

Clinical Pathway (CP) for Pediatric Acute appendicitis (AP) was implemented in our institution to improve healthcare delivery, lessen hospital costs and decrease complications. AP remains to be one of the most common surgical procedure throughout the world. We present our results comparing outcomes before pathway and after pathway implementation.

Methods.

This is a time-series study in which data of all patients who underwent appendectomies done one year before the pathway implementation (prepathway) and a year after (pathway) were collected.

Results.

Eighty-seven (87) cases were included (47 prepathway vs 40 pathway). The pathway group had a decreased average length of stay (4.13 vs 2.95 days, $p = 0.000$) with improved antibiotic timing (80 vs 53 minutes, $p = 0.000$). There was a decreasing trend in monthly cost per procedure but not statistical significant (Philippine peso 1977 vs 620.91, $p = 0.323$) after pathway implementation. Other outcomes were SSI rate (12.7 vs 2.5%, $p = 0.081$), negative appendectomy rate (14.9 vs 7.5%, $p = 0.284$), readmission (0 vs 2.5%, $p = 0.278$), time-to-appendectomy (5 hours, 8 minutes vs 4 hours, 25 minutes, $p = 0.180$).

Conclusion.

Since CP implementation, we have improved our healthcare delivery indicators for pediatric AP. We recommend CP use by other institution tailored to specific needs in their patients.

I. Introduction

BACKGROUND

Appendicitis is the most common abdominal emergency in adults and surgical emergency in children aged 5 years or older worldwide. The diagnosis of acute appendicitis is primarily clinical but the use of imaging and laboratory studies can greatly aid practitioners in making a more expeditious clinical diagnosis, preventing complications and limiting the rate of negative appendectomies [5]. The gold standard of treatment for acute appendicitis remains to be appendectomy, either open or laparoscopic procedure, with the latter becoming more common in the recent years[3]. Open pediatric appendectomy is one of the top surgical procedures performed in our institution [6].The practice of laparoscopic appendectomy in pediatric patients is still under development in our institution.

The diagnosis and management in children involve a unique set of challenges for clinicians. In order to efficiently diagnose and manage acute appendicitis (AP) in children, algorithms and clinical pathways are formulated and implemented to serve as a guide to healthcare providers.

Several algorithms have been developed to stratify patients into low, intermediate, and high-risk categories for acute appendicitis [5]. Some studies that have examined the efficiency of clinical pathways reveal that the use of laboratory tests, diagnostic delays, and even health insurance all play a part in the outcome of appendicitis management [4].

Systematic process of care is designed collaboratively based on scientific evidence and clinical standards in the form of clinical practice guidelines (CPG). The Philippine Health Insurance Corporation (PHIC) advocates the use of CPGs in the standard of patient care [7]. The development of CPGs entails extensive work which is costly and labor intensive.

Another approach in integrated health-care delivery is the use of a clinical pathway (CP). CP allows all members of the health-care team to recognize and understand the various clinical aspects of diseases or procedures throughout the patient's stay in the hospital. CP incorporates CPGs agreed on by experts in the field of the disease. A CP integrates the local clinical practices which are patient-centered (including cultural values and patient preferences) and evidence-based. It also provides an optimal order of assessment that could be pre-determined based on the patient's prioritized needs, reducing unnecessary costs.

In our institution, a CP was established for suspected cases of uncomplicated appendicitis. A multidisciplinary team composed of different clinical departments (Surgery, Pediatrics, Anesthesiology, Radiology), nursing service (Operating Room, Ward, Emergency Room), and ancillary staff (Pharmacy, Laboratory) convened and developed the CP for pediatric AP. The CP uses pediatric appendicitis score (PAS) for the initial clinical impression. Management will depend on the corresponding scores, with 8-10 being diagnostic of AP. A score of 5-7 will require a transabdominal ultrasound to aid in diagnosis, and a score of ≤ 4 is considered to have an alternate diagnosis. Admitted patients should be operated within six hours of diagnosis and antibiotics should be given within an hour of cutting time. Patients are discharged on the third postoperative day. All patients were scheduled for outpatient follow-up on the 7th and 30th postoperative day. The proposed clinical pathway has been approved for implementation by the Quality Assurance office of the institution. (Please see appendix A)

The WVSUMC is a tertiary government hospital with a 300-bed capacity. We cater to a wide geographic area in region VI. Our aim is to implement CPs for common diseases such as acute AP to improve quality healthcare delivery as well as standardization of the step-wise management of acute appendicitis. Our results will show the potential benefits of CP implementation by comparing its outcomes against a prepathway set of patients

STATEMENT OF THE PROBLEM

Among pediatric patients admitted at WVSUMC for uncomplicated acute appendicitis, does clinical pathway improve average length of stay, hospital cost, surgical site infection, readmission, negative appendectomy rate, antibiotic timing and time to appendectomy?

OBJECTIVES OF THE STUDY

General Objective:

To determine the difference between the outcome of management in pediatric patients with uncomplicated acute appendicitis admitted at WVSUMC before and after CP implementation.

Specific Objectives:

To compare the outcome of management in pediatric patients

diagnosed with uncomplicated acute appendicitis before and after CP implementation in terms of the following:

1. Average length of hospital stay
2. Hospital Cost
3. Surgical site infection rate
4. Readmission rate
5. Negative appendectomy rate
6. Antibiotic timing
 - a. ≤ 60 minutes prior to surgery
 - b. >60 minutes prior to surgery
7. Time to appendectomy
 - a. ≤ 6 hours
 - b. >6 hours

SIGNIFICANCE OF THE STUDY

This research will provide insights into the benefit of a clinical pathway in managing pediatric patients with acute appendicitis. Through this research, health care providers, especially physicians, will have improved efficiency in managing pediatric AP cases. Moreover, CPs have been used as a tool for quality improvement by hospitals. Institutions can improve policy making and provide recommendations regarding quality improvement in standards of care for patients with pediatric acute appendicitis. Lastly, other institutions, including the primary healthcare setting may apply the CP in managing pediatric AP cases.

Operational definition of terms

1. **Average length of hospital stay** – is the number of days from admission until discharge. For patients enrolled in the pediatric uncomplicated acute appendicitis clinical pathway, the recommended length of hospital stay is up to 3rd postoperative day.
2. **Clinical Pathway** – refers to the tool used in the management of patients with pediatric uncomplicated acute appendicitis.
3. **Hospital cost** – equivalent to the hospital expenses paid by the patient as reflected by the hospital bill, which includes cost of procedures, laboratories, and medications during the duration of the hospitalization
4. **Morbidity** – a complication or undesirable side effect following surgery, specifically the occurrence of surgical site infection.
5. **Negative appendectomy rate** – stated as the absence of neutrophilic infiltration on the walls of the appendix on final histopathology report
6. **Pediatric patients with acute appendicitis** – all patients 5-18-year-old presenting with abdominal pain with a classic history, peri-umbilical/ epigastric abdominal pain with migration to right lower quadrant and with physical examination showing localized direct tenderness or guarding at the RLQ/ hypogastrium, and/or accompanied by hopping tenderness or pain upon coughing or percussion.
7. **Readmission rate** – readmission with an overnight stay within 30 days upon initial discharge
8. **Rebound tenderness** - a sign of acute appendicitis wherein the patient feels pain on right lower quadrant of the abdomen when pressure of deep palpation on that area is released
9. **Surgical site infection** - Infection occurs within 30 days after the operation and infection involves only skin and subcutaneous tissue of the incision and at least one of the following: ¹³
10. Purulent drainage with or without laboratory confirmation, from the superficial incision
11. At least one of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness, or heat
12. **Time to appendectomy** – the time interval from patient admission to commencement of the surgery. CP target is within six hours of admission.
13. **Timely administration of antibiotic to surgery**- time (in minutes) interval from administration of prophylactic antibiotic to the time of surgical incision. CP target is within an hour of surgery
14. **Uncomplicated appendicitis**- patients with history and physical exam consistent with appendicitis, localized pain at the right lower quadrant and intraoperative finding of an inflamed or suppurative appendix.
15. **Variations** – any event that deviates from the prescribed steps in the clinical pathway.

ii. Review Of Related Literature

This study will determine whether there is an impact in utilizing a clinical pathway in the management of pediatric uncomplicated acute appendicitis admitted in WVSUMC. The focus of this literature review will

be on clinical pathways on acute AP and its standard of care, the benefits of using a clinical pathway as quality improvement (QI) and the various QI indicators being studied.

Numerous studies have focused on the clinical pathway in acute appendicitis among the adult population. However, no study evaluates the use of a clinical pathway and its impact in the management of uncomplicated pediatric acute appendicitis that exist in our locality.

CLINICAL PATHWAYS

Patient care safety is advocated by PHIC. It requires the use of an organized and integrated multidisciplinary approach in healthcare delivery using CP and CPG. It promulgates the details and important aspects of the diagnosis and treatment of a disease or a procedure. CPGs are usually done by national medical societies like the Philippine College of Surgeons (PCS) to serve as guides for its constituents to follow. The other form of such approach in integrated health-care delivery is the use of a Clinical Pathway (CP). CP is a document, which allows all members of the health-care team to know the various clinical aspects of diseases or procedures throughout the patient's stay in the hospital. CP incorporates CPGs agreed on by experts in the field of the disease like national medical societies. It integrates the best clinical practices, which are patient-centered and evidence-based in a CP document. This document outlines the type of clinical events such as services and interventions the patient should receive and the time at which these are to be accomplished through the course or stay of patients in the hospital. It generally standardizes the health-care provision. In the absence of a document like CPs, the patient experience in the hospital is very difficult to document. Documentation is an important part of continuous quality improvement of the hospital and for accreditors and surveyors of PhilHealth and DOH [8].

In a Cochrane Review, it was established that Clinical Pathways may be associated with reduced complications and improved documentation when implemented in hospitals without negative impact on length of stay or costs [9, 10]. The use of clinical pathways, clinical practice guidelines and other forms of evidence-based guides (algorithm, workflows, graphs, timeline checklist) are therefore advocated by PhilHealth and DOH.

CLINICAL PATHWAYS ON PEDIATRIC ACUTE APPENDICITIS

A study where 120 consecutive patients were entered prospectively into a CP for acute appendicitis. The results of the study showed a significantly shortened response time for surgical consultation, a greater proportion taken to the operating room within 3 hours and more patients received antibiotics before transfer to the operating room. There was also a significant reduction in the duration of hospitalization. The clinical pathway had no adverse effect with regard to rates of wound infection. Total hospital costs were significantly reduced in patients with normal or acute, nonperforated appendicitis as well as in patients with perforated appendicitis. Negative appendectomy rates were the same between the pathway and the nonpathway groups [12].

An institutional protocol for appendectomy for uncomplicated appendicitis in pediatric patients is associated with a high rate of receipt of antibiotics and a low surgical site infection (SSI) rate. Stone and Classen et al. demonstrated that the lowest rates of SSI in abdominal and cardiac operations were achieved when prophylaxis was started within 1 hour of incision [19]. In a study conducted by Teixeira (2012), a delay of more than 6 hours in performing appendectomy was independently associated with increased incidence of SSI. Appendectomy delay was found to be particularly detrimental for patients with a nonperforated appendicitis. For this group of patients, an appendectomy delay of more than 6 hours resulted in an increase in the incidence of SSI from 1.9–3.3% ($P = 0.03$) [20]. This is the rationale why the CP has adapted the timing of preoperative antibiotic administration and the time to appendectomy.

In one study by Emil (2006), they included readmission rate as one of their variables and found out that none of the patients treated on pathway required readmission for short-term, postoperative complications versus 4.5 per cent of patients treated off pathway ($P < 0.05$) [15]. The rationale being that a high rate of emergency readmissions may indicate problems with the quality and safety of care. Readmission rate is considered one of the quality indicators [16].

Clinical pathways have long been established to improve clinical outcomes in hospitalized patients. Use of CPs in the pediatric population diagnosed with appendicitis also has been proven to be beneficial. The most commonly measured quality indicators among CPs are average length of stay, hospital cost and reduction of complications. Other studies have measured efficiency of healthcare providers by determining timing of antibiotic administration and timing of surgery.

iii. Methods

This is an interrupted time series study which determined the differences in outcomes between the utilization and non-utilization of a clinical pathway for pediatric patients with uncomplicated acute appendicitis admitted at WVSUMC. The demographic profile of patients enrolled in the pathway and those not enrolled in the pathway was described. Moreover, the impact of the clinical pathway on patient outcomes were compared according to average length of stay, hospital cost, surgical site infection rate, readmission rate, negative appendectomy rate, antibiotic timing, and time to appendectomy.

Study Setting

The study was conducted at West Visayas State University Medical Center, E. Lopez St., Jaro, Iloilo City.

Study Period

The study included patients from the pre-pathway period (October 2018-September 2019) and the pathway period (October 2019-September 2020).

Study Population

This study included all pediatric patients diagnosed with uncomplicated appendicitis admitted in October 2018-September 2019 (pre-pathway group) and October 2019-September 2020 (pathway group).

Inclusion Criteria:

1. All service pediatric (5-18 years old) patients clinically diagnosed to have uncomplicated appendicitis

Exclusion Criteria:

1. Patients with complicated appendicitis
2. Patients with unstable comorbidities (ASA III or more, e.g., asthma with exacerbation, poorly controlled epilepsy)
3. Patients who are pregnant
4. Immunocompromised patients
5. Patients who dropped out of the pathway due to failure to follow up at the OPD.

Sample Size

All pediatric patients (5-18 yo) with uncomplicated appendicitis a year before and a year after the pathway implementation was included. A total of 87 patients were included in the study; 47 from the pre-pathway group and 40 from the pathway group. 1 patient was excluded from the study because of failure to follow up at the OPD on the 30th postoperative day.

Maneuvers

Research Procedure

Permission from the hospital administration for the conduct of the study was sought through a letter of permission and copy of the study proposal. Budget was approved by the research committee, and the timeline for the study was followed (please see appendix B). A letter was sent to the chairman of WVSUMC medical records office requesting access to patients' health records (appendix C). Appropriate patients from the health records (pediatric patients with uncomplicated acute appendicitis) were identified based on the exclusion and inclusion criteria. Participants' health records were reviewed to determine for the average length of stay, hospital cost, surgical site infection, readmission rate, negative appendectomy rate, antibiotic timing and time to appendectomy.

The data collected was processed, analyzed, and presented using the statistical tools described below.

Data Collection, Processing and Analysis

Data Collection

A data collection tool in the form of printed sheets containing all the needed information from the patient's health record (please see appendix D) was prepared for the collection and summary of data. The data collection tool was completed by the researcher by examining the patient's hospital chart, maintaining confidentiality by using a coding system.

Data Processing and Analysis

The data gathered was encoded and analyzed using SPSS version 21. The study participants were described using frequency, percentage, mean, standard deviation and range. Mann-Whitney U Test and Odds ratio was used to compare whether there are differences in the outcomes of those patients enrolled under the clinical pathway versus the pre-pathway group. Statistical significance will be determined by a p-value < 0.05. A time series graph was used to determine the trend in average hospital cost per month since implementation of the CP (please see figure 3).

SCOPE AND DELIMITATION OF THE STUDY

This study will only focus on pediatric patients (5-18 years old) admitted at West Visayas State University Medical Center with a diagnosis of acute uncomplicated appendicitis. The goal of this study is to determine the impact of a clinical pathway among pediatric appendicitis patients. The population studied will include patients diagnosed within a 2-year period: October 2018-September 2019 (pre pathway group) and October 2019- September 2020 (pathway group). The study will focus on the impact of the clinical pathway in terms of patients' average length of stay, hospital cost, surgical site infection rate, readmission rate, negative appendectomy rate, antibiotic timing and time to appendectomy.

The study will not include complicated appendicitis (e.g., gangrenous and perforated appendicitis, abscess formation), patients with unstable comorbidities (ASA III or more, e.g., uncontrolled asthma), patients needing general anesthesia and pregnant patients as these have widely variable postoperative course and management will be curtailed individually.

Ethical Considerations

This research was reviewed and approved by the Unified Research Ethics Review Committee (URERC) of West Visayas State University.

Strict confidentiality was employed; information about the participants' identity was only known to the researchers who conducted the study. Precautionary measures were taken to protect information including but not limited to those which were printed on paper, stored in electronic media, and shared verbally or visually. Data on paper was stored, secured, and was retrieved, when necessary, only by the members of the research team. Identities of the respondents were anonymized by using a coding system.

The findings of this study will be presented in West Visayas State University Medical Center Department of Surgery and may also be presented in scientific forums or published in scientific journals. Anonymity

and confidentiality were maintained throughout the study. Raw data will be kept by the researcher for a period of three years, after which they are to be shredded and electronic sources permanently deleted.

IV. Results

Table 1

Demographic characteristics, antibiotic timing and time to appendectomy of 87 patients with uncomplicated appendicitis admitted at WVSUMC from October 2018 to September 2020

	All patients n(%) 87(100)	Pre pathway n (%) 47(54)	Pathway n(%) 40(46)	Mean difference	P value
Age (Mean in years \pm SD)	14.62 \pm 3.54	13.89 \pm 3.97	15.47 \pm 2.75	1.58	0.07
Gender, n(%)					
Male	47 (54)	23 (48.9)	24 (60)		
Female	40 (46)	24 (51.1)	16 (40)	-	0.308
Antibiotic Timing					
\leq 60 minutes	61(70.1)	23(48.9)	38(95)		
>60 minutes	26(29.9)	24(51.1)	2(5)		
Mean (minutes \pm SD)	67.8	83 \pm 64	50 \pm 17	33	0.000*
Time to appendectomy (hours)					
\leq 6 hours	72(82.7)	35(74.4)	37(92.5)		
> 6 hours	15(17.3)	12(25.6)	3(7.5)		
Mean (hours and minutes \pm SD)	4:48 \pm 3:43	5:08 \pm 3:35	4:25 \pm 4:03	0:43	0.180
<i>*significant at p<0.05</i>					

From October 2018 through September 2020, 87 patients were included in the study. 47 from the pre-pathway group and 40 from the pathway group. There were no differences in age between groups. The mean age for the prepathway group is 14.62 \pm 3.54 years and 15.47 \pm 2.75 years for the pathway group, $p < 0.063$. As per their gender, uncomplicated acute appendicitis was equally observed among males and females (54% vs 46%, $p = 0.308$)

Among those in the pre-pathway group, 48.9% of the patients received their antibiotics in 1 hour or less before their surgery. Comparing this to the pathway group, 95% were given their antibiotics in less than an

hour. The mean antibiotic timing was significantly better in the pathway group (83 ± 64 vs 50 ± 17 minutes, $p < 0.000$)

For the time to appendectomy, 74.4% of patients in the pre-pathway group had their respective surgery in less than or equal to six hours. In the pathway group, 92.5% had their surgeries in less than six hours after diagnosis. There was no significant difference in average time to appendectomy between the 2 groups (5 hours and 8 minutes \pm 3 hours and 35 minutes vs 4 hours and 25 minutes \pm 4 hours and 3 minutes, $p = 0.180$).

Table 2

Outcomes of 87 pediatric patients with acute appendicitis admitted at WVSUMC before and after implementation of the clinical pathway

	All patients	Pre pathway n(%)	Pathway n(%)	Mean difference	OR (95% CI)	P value
Average length of stay (days \pm SD)	3.6	4.19 \pm 1.12	2.95 \pm 0.32	51.24	-	0.000*
Mean Hospital Cost in (PHP \pm SD)	1353.5	1,977 \pm 3,503	620.91 \pm 1,002.06	1356.09	-	0.323
Surgical Site Infection n(%)	7(8.0)	6(12.7)	1(2.5)	- a	0.18 (0.02–1.52)	0.114
Readmission n(%)	1(1.1)	0(0)	1(2.5)	-	-	0.278
Negative appendectomy n(%)	10(11.5)	7(14.9)	3(7.5)	-	0.46 (0.11–1.93)	0.289

Patients on the pathway had a significantly shortened hospital stay (4.19 vs 2.95 days, $p < 0.00$). The mean hospital cost was decreased by Php 1353.50, however it did not reach statistical significance (Php 1,977 \pm 3,503 vs 620.91 \pm 1,002.06, $p < 0.323$). The odds of pathway patients developing SSI compared to prepathway patients has been reduced, however it did not reach statistical significance (OR = 0.18, 95% CI [0.02–1.52]). There is also no significant difference in the odds of having a negative appendectomy between the pathway and prepathway group (OR = 0.46, 95% CI [0.11–01.93]). The results only showed a lone case of readmission, which was found in the pathway group.

Figure 3 shows a time series graph of the average monthly hospital cost of patients admitted within the time period of study (October 2018-September 2019 pre-pathway and October 2019- September 2020 pathway)

Table 3
 Variances noted in the pathway since its
 implementation (October 2019)

	n(%)
Hypokalemia	2(4.6)
Pulmonary Tuberculosis	1(2.3)
Early discharge (positive variance)	3(6.9)
Rheumatic heart disease	1(2.3)
Hypersensitivity reaction (food)	1(2.3)
Complicated appendicitis	2(4.6)
Dropped out/ no OPD follow up	1(2.3)

Variance are deviations from the prescribed steps in the CP, which are shown in Table 3. Looking at the patients enrolled in the pathway, the top 3 variances were early discharge, hypokalemia, and complicated appendicitis. There were 3 cases (6.9%) who were qualified for early discharge. As early as the second post operative day, these patients were able to tolerate oral feeding and had stable clinical status thus were qualified for early discharge. There were 2 patients with hypokalemia, which was corrected accordingly. Two patients were initially diagnosed to have uncomplicated appendicitis, but upon intraoperative assessment, had a perforated appendix thus was put off pathway. One patient failed to show up at the OPD on the 30th day post op for SSI monitoring, thus was excluded from the study (attrition rate of 2.3%).

V. Discussion

The purpose of this study was to determine whether the use of clinical pathway improve outcomes in pediatric patients with acute uncomplicated appendicitis in our institution. Earlier studies done locally and abroad have already described the benefits of clinical pathways among adults.

The outcomes measured in the study were average length of stay (days), hospital cost (Php), surgical site infection, readmission, negative appendectomy rate, antibiotic timing and time to appendectomy. The results of the study indicate that the use of CP in the management of pediatric appendicitis has significantly reduced the average length of stay (LOS). This translates to an improved hospital bed turnover, e.g, in a 30-day period, this will translate to 10 patients catered as compared to 7 when the CP was implemented. The results of this study are congruent with previous studies, in that clinical pathways for acute appendicitis will shorten length of hospitalization [11, 12]. This may be due to CPs advocating early feeding post appendectomy. Early resumption of feeding not only leads to early toleration of a full

diet, but also leads to shorter hospital stay with no increase in complications [21]. In our CP, general liquids are being given as early as 8 hours post op, and may have full diet the next day. Along with clinical status, toleration of oral feeding was the most important criteria for discharge [21]. Our results noted 3 cases in the pathway group where the patient was able to tolerate full feeding as early as 2 days with stable clinical status, and thus were discharged.

Cost savings is one of the quality improvement goals of a CP. As seen in our results, there is no significant difference in the mean hospital cost between the two groups. Previous literatures have showed that use of CP will significantly decrease hospital cost, which is in contrast to our results [11, 12]. However, comparing the trend of average cost of hospitalization per month, the data shows that there will be less cost of hospitalization from the pathway group. Generally, economic significance will depend on the perspective of the patient and patient's folks. The study population only included service patients, which belong to the lower income class of the society. From the start of our study (2019), the minimum wage in the Philippines is Php 481 [24], thus the amount saved of pathway patients is almost triple the minimum wage. The use of CP has reduced the use of unnecessary laboratory requests and antibiotics thus translating to decreased hospital cost.

Uncomplicated appendicitis is classified as a clean contaminated surgery. Reported SSI rates for clean contaminated surgeries ranges from 2.1–9.5%. Uncomplicated appendicitis specifically has an SSI rate of 5% [23]. Our results showed that there is no difference in SSI rates between the prepathway and the pathway groups. However, it is still notable that by descriptive statistics there was an improvement in the SSI rate. The clinical impact of this is still important since the burden of the complication will still hinder the affected patients developing SSI. The decrease in SSI rate might be due to the pathway compliance and adherence to the international standard of antibiotic timing (within an hour of cutting time), and appendectomy within six hours of admission. Only 2 out of the 40 patients from the pathway group failed to receive their antibiotics within the prescribed one hour from cutting time. And only 3 out of the 40 pathway patients had their surgery beyond the advised time of six hours from admission [20].

Establishment of the clinical pathway also had a salutary effect on the efficiency of patient management. With the healthcare team aware of the steps of the pathway, they were able to comply and deliver what was advised. Antibiotic timing (≤ 1 hour from surgery) has significantly improved. The pre pathway patients received their antibiotics with a mean time of within 83 minutes from surgery, and the pathway group received theirs with an average time of 50 minutes. Preoperative antibiotics should be given within an hour of cutting time to achieve the lowest rates of SSI [19]. However, the direct relationship between antibiotic timing and SSI rates is beyond the scope of this study. One study has reported that a delay of more than 6 hours prior to appendectomy was associated with an increased incidence of SSI as well [20]. Since the implementation of the CP, there was increase in the percentage of patients who were operated within six hours of admission. The average time from admission to appendectomy has also improved. Both antibiotic timing and time to appendectomy are measures of efficiency of the healthcare team responsible for the management of pediatric patients with uncomplicated acute appendicitis. However,

there are a myriad of variables that may affect both quality indicators. The purpose of the CP is to encompass these variables and prepare the clinical team to deliver better care.

We have adapted the use of pediatric appendicitis score (PAS) in our CP. We have found out that the use of PAS has widespread adaptability in our clinical practice. A score of 8–10 is considered diagnostic of AP, and a score of 5–7 will require a transabdominal ultrasound to help make the diagnosis. A score of 4 or lower is considered to have an alternate diagnosis. Acceptable negative appendectomy rates among pediatrics is around 6–10%, with an average of 8.7% [25]. Intra-operative information about the uncomplicated acute appendicitis would indicate suppurative findings, however final histopathological studies sometimes reveal lymphoid follicular hyperplasia which indicates a negative appendectomy case. The results showed a lower incidence of negative appendectomy rate in the pathway group. However, the difference calculated was not extensive to indicate statistical significance.

Readmission rate due to uncomplicated appendicitis is a rare occurrence. The study only noted one case of readmission and it was noted among the pathway group. It was one case of post operative adhesion occurring 15 days postop.

Vi. Conclusions

While acute appendicitis is the most common surgical emergency among pediatrics, only a few institutions have developed and implemented a clinical pathway for quality improvement. Our results showed that the use of a clinical pathway in pediatric uncomplicated appendicitis leads to significantly shorter hospital stay and improved antibiotic timing. It also resulted to lower hospital cost, SSI and negative appendectomy rates as well as improvement in timing to surgery. The clinical pathway (CP) provides an easier and a more structured way in managing patients, promoting its use even in the primary health care setting.

The goal of the CP is to achieve 100% compliance and adherence to the standard of management. However, the results revealed some cases wherein the healthcare team were unable to achieve those. Perhaps better ways of information dissemination and frequent quality care audit is needed to improve on this.

We recommend that other institutions similar to ours will adhere to a CP tailor fit to their clinical needs. Future studies can focus on cost effective analysis of a clinical pathway, increasing the time period and the study population, and include complicated appendicitis to the population group.

In addition, due to its positive overall impact in terms of patient care, it is also highly recommended that the primary health care institutions adapt the use of this clinical pathway. The use of CP should be encouraged by local district hospital administrators, especially those institutions having a multidisciplinary approach in the management of acute appendicitis.

Declarations

Funding and Competing Interests

1. The authors have no conflicts of interest, whether financial, personal, or institutional, that are relevant to the work conducted or reported in this manuscript.
2. All funding sources supporting the work is from personal expenses of the corresponding author.

Ethics Approval

This research was reviewed and approved by the Unified Research Ethics Review Committee (URERC) of West Visayas State University.

Consent to Participate and Consent to Publish

Informed consent was obtained from all individuals included in the study via their parents or legal guardian. A consent was also obtained for possible publication of the collected data.

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Figures

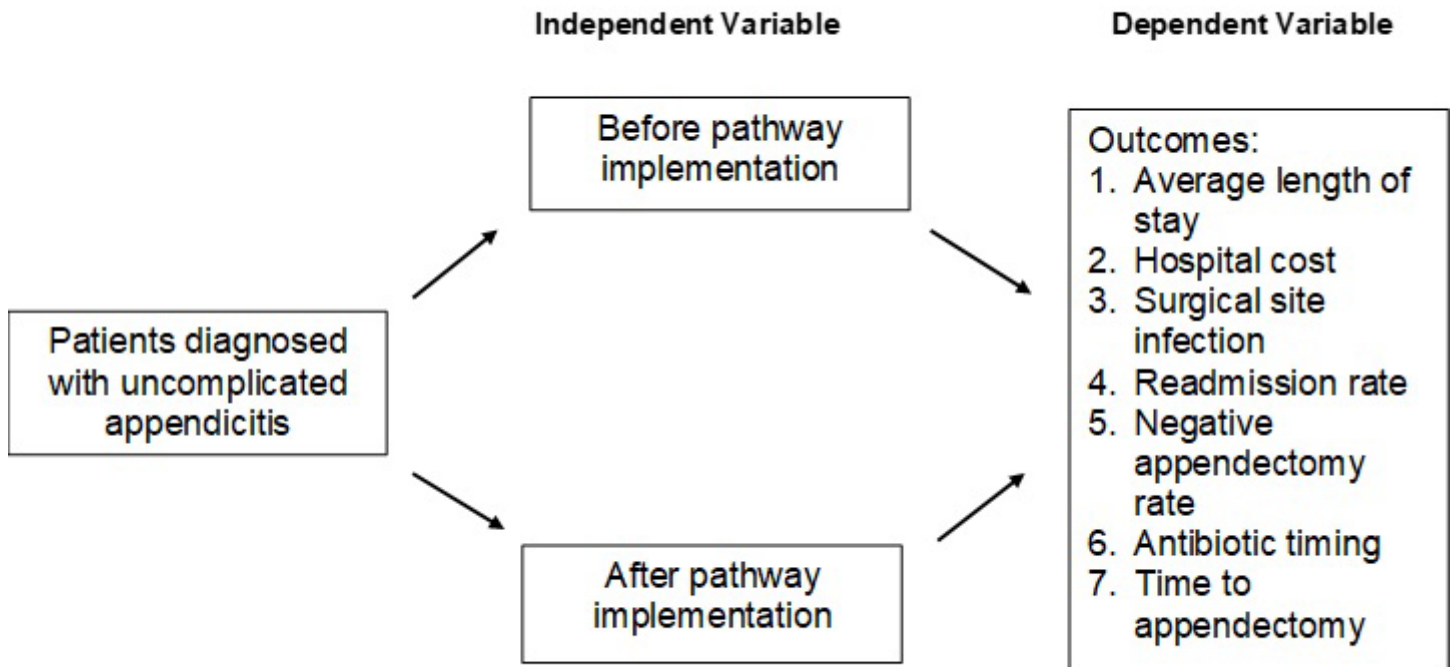


Figure 1

Conceptual Framework

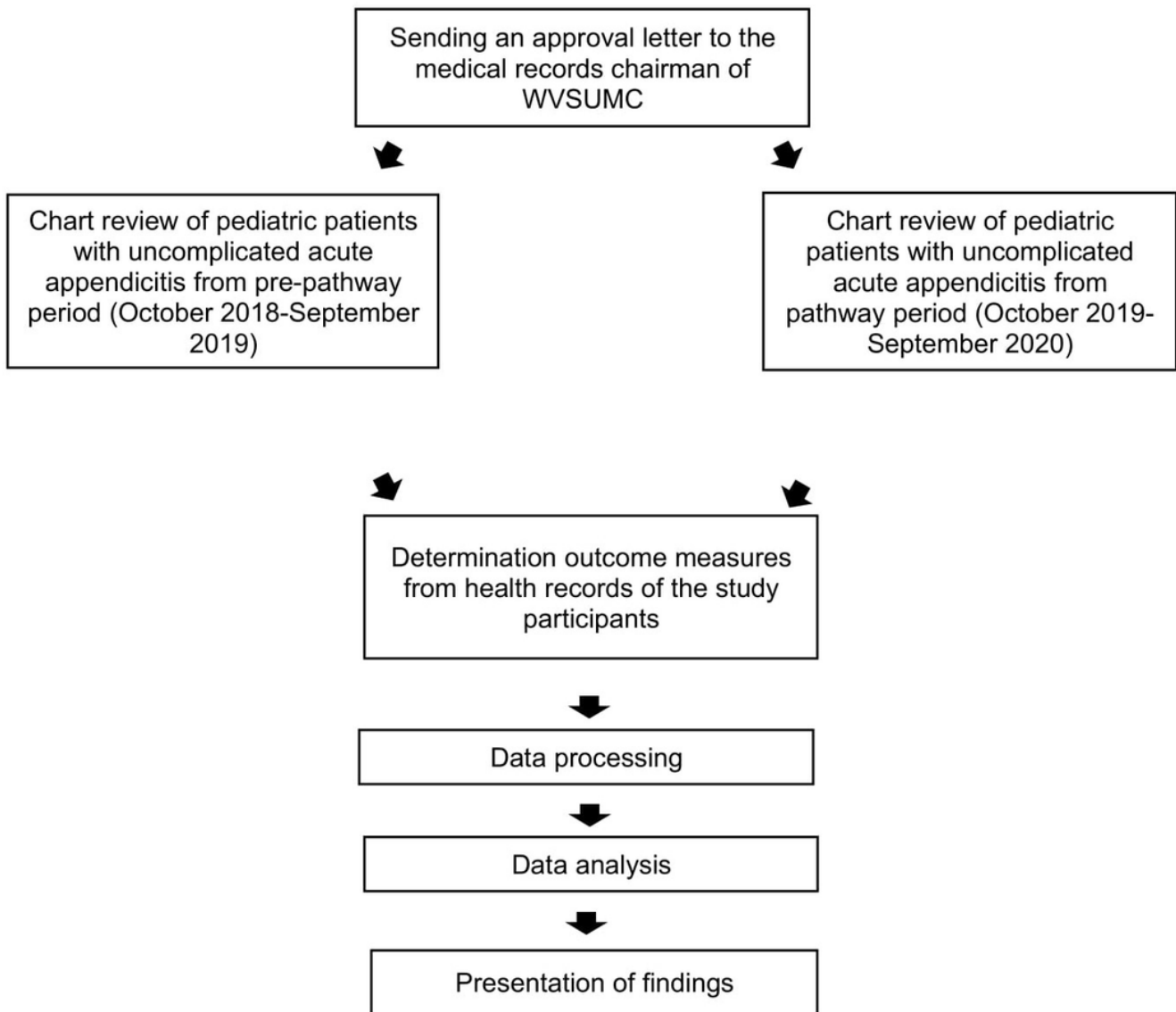


Figure 2

Schematic diagram of the research procedure

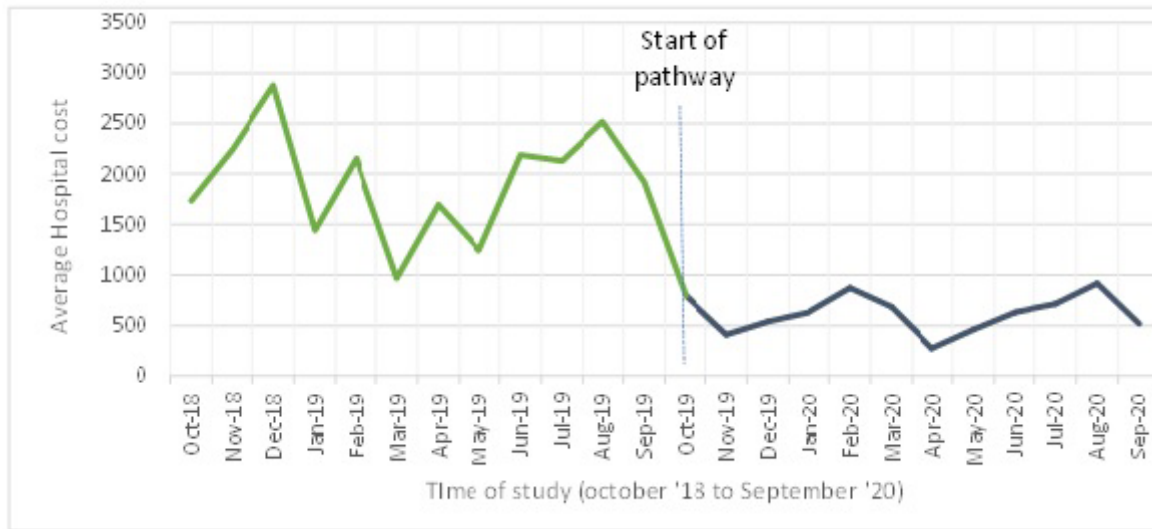


Figure 3

Legend not included with this version

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