ORIGINAL ARTICLE

Adherence to Clinical Practice Guidelines on the Management of Acute Infectious Gastroenteritis in Children as a Measure of Quality of Care Delivered by a Primary Care Facility in Rural Philippines: A Descriptive Retrospective Study

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ABSTRACT

Objectives. This study aimed to describe the pattern of prescription and laboratory use in the management of infectious acute gastroenteritis (AGE) in children seen in a rural service delivery network (SDN) and to determine their adherence to the 2019 Clinical Practice Guidelines on the Management of Acute Infectious Diarrhea in Children and Adults from the Department of Health (DOH).

Methods. A descriptive retrospective study was done using the electronic medical records (EMR) of patients less than 19 years old seen by the rural SDN from April 2019-2021 and diagnosed with infectious AGE. Data were extracted on diagnostic and therapeutic management. Adherence to strong CPG recommendations focusing on rehydration, zinc supplementation, rational laboratory use, and antibiotic prescription was chosen as indicator of quality of care. Adherence of less than 70% was defined as low.

Results. There were 227 infectious AGE cases, with 72% diagnosed under non-specific infectious AGE. Fifty two percent (52%) were prescribed with low-osmolarity oral rehydration solutions (ORS), while 74% were given zinc. Stool analysis was done in 25% of cases while CBC was done in 20%. Top antibiotics given were metronidazole at 44% and cotrimoxazole at 33%. There was low adherence to prescribing low-osmolarity ORS for rehydration (52%) and to deferring routine antibiotic prescription for non-specific infectious AGE cases (24%). Adherence to deferring routine stool analysis and CBC were relatively high at 73% and 70%, respectively while adherence to antibiotic use for indicated cases was high at 95%.

Conclusion. Frequency of diagnostics ordered were low resulting to high adherence rates to recommendations concerning judicious laboratory use. Prescription frequency of appropriate antibiotics and interventions for AGE were low, leading to low adherence rates to recommendations concerning rational antibiotic use and prescription of cornerstone therapies for infectious AGE.

Keywords: diarrhea, infectious gastroenteritis, primary care

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INTRODUCTION

Philippine Primary Care Studies

Inequities in healthcare access continue to plague the Philippine healthcare system. In 2016, the Philippine Primary Care Studies (PPCS) was launched to examine how the transition to an improved primary care delivery system can address the problems leading to inequities in healthcare access. A key component of this primary care system is a centrally funded service delivery network (SDN) formed by a central primary care facility and its peripheral health stations. These SDNs are supported by a robust EMR that would record patients' visits and efficiently collate data on disease prevalence, management patterns, and health expenditures, among other things. PPCS established a pilot SDN in three locations, starting with the urban site SDN in 2016 and then followed by the rural and geographically remote site SDN in 2019.[1]

The quality of care delivered by the SDN is a key outcome measure of the study. The WHO Manual on the Utilization of Core Drug Use Indicators in Health Facilities suggest that the measure of adherence of prescription patterns to existing clear guidelines for common, well-defined health problems is a very useful indicator of quality of care.[2] This paper aimed to assess the quality of care delivered by the rural SDN site by using its adherence to the existing clinical practice guidelines on the management of infectious acute gastroenteritis in the pediatric population as a measure of quality of care.

Infectious Acute Gastroenteritis

Infectious AGE most often presents as diarrhea defined as the passage of three or more stools with decreased or watery consistency in a 24-hour period.[3] Episodes may be bloody or non-bloody and should last for less than 14 days.[4]

Despite the social and economic burden due to its high incidence, infectious AGE is most often a mild and self-limiting disease with simple management based on straightforward recommendations.[5] However, variable adherence to existing guidelines have been reported in practice, with reasons ranging from persistence of local traditions to limitations in drug and resources availability.[6] The variability of adherence to key recommendations tend to increase the economic burden of AGE through excessive procedures and medical interventions.[7] A prospective, randomized intervention trial done in Italy has shown a significantly shorter duration of diarrhea (in hours; 103.58 + 44.7 vs 112.8 + 47.9; $p < .01$) in cases managed in accordance to an established clinical guideline[8], while a multi-institutional study at children's hospitals done in the USA showed that emergency departments and ambulatory clinics adherent to established guidelines have 50% lower charges without compromising health outcomes.[9] These two studies show that adherence to an established clinical practice guidelines can possibly ease the burden of infectious AGE through decreased healthcare costs and better health outcomes.

2019 DOH Clinical Practice Guidelines on the Management of Acute Infectious Diarrhea in Children and Adults

The Clinical Practice Guidelines on the Management of Acute Infectious Diarrhea in Children and Adults (CPG) was formulated by the Food and Waterborne Diseases Prevention and Control Program (FBWD-PCP) launched by the Department of Health (DOH) with the aim of standardizing the approach to the diagnosis, management, and prevention of AGE among immunocompetent pediatric (<19 years) and adult (19 years and above) patients. The CPG was based mainly on findings of systematic reviews, meta-analysis, and clinical trials, as well as consideration of local practices using The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) methodology. Development of the CPG was carried out from 2016 through 2017 and was eventually published in 2019. Decision on when to update the guideline will be determined by the steering committee depending on their review of current literature.[3]

The Appraisal of Guidelines for Research and Evaluation II (AGREE II) tool is an instrument used mainly to assess the quality of CPGs. It consists of 23 items arranged into 6 domains with each domain encapsulating a specific dimension of guideline quality.[10] In this study, the AGREE II tool was used to appraise the CPG on the management of acute infectious diarrhea to ensure that biases in its development have been addressed and to ascertain the validity and applicability of the recommendations in the Philippine setting. The CPG had a high scaled domain score ranging from 95-100% on all 6 domains and was appraised as recommendable for use in the primary care setting by the primary investigator and one other independent reviewer (Appendix).

Key statements in the CPG include common universally accepted interventions in the management of infectious AGE such as administration of low-osmolarity oral rehydration solution (ORS) for volume replacement, age-appropriate zinc supplementation, probiotics supplementation, specifically with *Saccharomyces boulardii* and *Lactobacillus rhamnosus GG*, and deferral of anti-diarrheal and anti-emetic use. The CPG also does not recommend the prescription of empiric antibiotics and routine orders of laboratories such as stool analysis and complete blood count (CBC) for common cases of infectious AGE with non-bloody diarrhea. Antibiotic use is strongly recommended to be reserved for cases of bloody diarrhea and for cases with highly suspected or confirmed bacterial or parasitic etiology. Specifically, the CPG recommends the use of oral azithromycin for cholera, intravenous ceftriaxone for shigellosis, and oral metronidazole for suspected or confirmed cases of amoebiasis.[3] These statements have strong recommendations and were used as basis in determining the rural SDN's adherence to guidelines and quality of care.

OBJECTIVES

This study aimed to describe the pattern of drug prescription and laboratory use in the management of infectious AGE in pediatric patients seen in a rural SDN. Specific objectives include the following: 1) to determine the types and frequency of medications and laboratory test used in the management of infectious AGE, and 2) to describe adherence to key recommendations by determining the percentage of cases managed in accordance to a specific recommendation from all cases for which the recommendation is applicable.

MATERIALS AND METHODS

Research Design and Sampling

This is a descriptive retrospective study done at a rural SDN from April 2019 to April 2021. The inclusion and exclusion criteria are as follows:

Inclusion Criteria

This study included all consults among children age less than 19 years old who were diagnosed with infectious AGE with ICD-10 code A09 (unspecified gastroenteritis of infectious origin), A06 (amebiasis), A03 (shigellosis), or A00 (cholera) and were managed on an out-patient basis at the rural SDN.

Exclusion Criteria

Cases of infectious AGE with moderate to severe dehydration which required intravenous hydration and immediate referral to a higher care facility were excluded from the study. Cases of diarrhea, which were diagnosed to be non-infectious (ICD-10 code K52.9), were also excluded from the study.

Description of Study Procedure

Data Collection

The EMR of the rural SDN was searched for charts of cases diagnosed under ICD-10 codes A09, A06, A03, and A00 only. Chart review was done to retrieve information on each patient's sex, age, signs and symptoms, and ICD-10 diagnosis. Healthcare providers' orders were reviewed to retrieve information on medications prescribed and laboratory tests requested for these cases.

Indicators of adherence to CPG

The DOH CPG on the Management of Acute Infectious Diarrhea in Children and Adults 2019 was used as the basis for recommendations in the management of infectious AGE. Only statements with strong recommendations were included as indicators of adherence.

Statistical Analysis

Categorical data were presented in terms of frequencies and percentages while continuous data were presented using ranged categories and mean. The frequency of medications prescribed and diagnostic tests ordered were tallied and presented as a percentage of all cases seen. Percentage of adherence to a specific CPG recommendation was determined as the number of cases correctly managed according to the recommendation divided by the number of all cases for which the recommendation was applicable multiplied by 100. Ideally, all cases must have been managed according to the CPG and adherence must be 100% for all recommendations. This study has arbitrarily defined an adherence of less than 70% as low. The recommendations were grouped into three categories depending on the cases for which they are applicable and were presented here with their corresponding formula for adherence.

Group 1: Recommendations for all cases of AGE

Statement 1: Zinc supplementation recommended for children > 6 months of age
formula: [# of all cases >6 months of age with Zinc prescribed] ÷ [# of all cases of AGE >6 months of age] x100

Statement 2: Zinc supplementation not recommended for children <6 months of age
formula: [# of all cases <6 months of age without Zinc prescribed] ÷ [# of all cases of AGE <6 months of age] x100

Statement 3: Low-osmolarity ORS is recommended to replace ongoing losses.
formula: [# of all cases with low-osmolarity ORS prescribed] ÷ [# of all cases of AGE] x100

Statement 4: Probiotics (*Saccharomyces boulardii, Lactobacillus rhamnosus GG*) is recommended as adjunct therapy.
formula: [# of all cases with probiotics prescribed] ÷ [# of all cases of AGE] x100

Statement 5: Loperamide prescription is not recommended.
formula: [# of all cases with no loperamide prescribed] ÷ [# of all cases of AGE] x100

Statement 6: Anti-emetic prescription is not recommended.
formula: [# of all cases with no anti-emetic prescribed] ÷ [# of all cases of AGE] x100

Group 2: Recommendations for AGE with non-bloody diarrhea

Statement 7: Routine stool analysis not indicated for acute watery diarrhea.
formula: [# AGE with non-bloody diarrhea cases with no stool analysis ordered] ÷ [# of all cases of AGE with non-bloody diarrhea] x100

Statement 8: Routine serum WBC not indicated for acute watery diarrhea.
formula: [# of AGE with non-bloody diarrhea cases with no CBC ordered] ÷ [#all of cases of AGE with non-bloody diarrhea] x100

Statement 9: Routine empiric antibiotic therapy is not recommended.
formula: [# of AGE with non-bloody diarrhea cases without antibiotics prescribed] ÷ [# of cases of AGE with non-bloody diarrhea] x100

Group 3: Recommendations for AGE with bloody diarrhea or AGE with suspected specific infectious agent (A00- cholera, A03- shigellosis, A06- amebiasis)

Statement 10: Antibiotics are recommended for AGE with bloody diarrhea or with suspected specific infectious agent (A00- cholera, A03- shigellosis, A06- amebiasis).
formula: [# of AGE with bloody diarrhea or with suspected specific infectious agent (A00- cholera, A03- shigellosis, A06- amebiasis) cases with antibiotics prescribed] ÷ [# of all cases of AGE with bloody diarrhea or with suspected specific infectious agent (A00- cholera, A03- shigellosis, A06- amebiasis)] x100

Ethical Considerations

The primary investigator declares no conflict of interest. This study was done through the provision of Philippine Primary Care Studies as one of the performance indicators for quality of care. The Philippine Primary Care Studies has been granted ethical clearance by the University of the Philippines Manila Research Ethics Board (UPMREB) under study protocol code UPMREB 20-15-489-01. The data from the EMR was collected and tallied by the data manager using Microsoft Excel with randomly assigned alphanumeric identifiers per patient and was handed to the primary investigator. Personal identifiers such as names and contact information were not included in data gathering. The file was stored in a password-protected laptop accessible only to the primary investigator. This will remain in the possession of the primary investigator until five years after the completion of the study and will be deleted thereafter. Confidentiality of data was ensured throughout the study process.

RESULTS

The EMR search yielded 227 cases of infectious AGE in the pediatric population seen and managed from April 2019 to April 2021 at the rural SDN. This is 1.6% of all 14,471 pediatric consults seen during the study period. One hundred seventy-nine (179) cases (79%) were seen during the pre-pandemic period, while 48 cases (21%) were seen during the pandemic period.

A total of 127 (56%) cases were male and 100 cases (44%) were female. The mean age for pediatric patients with AGE is 4.23 years old (SD + 7.07), with 164 cases (72%) belonging to the age group of 5 years and below. Table 1 shows the clinicodemographic profile of the cases included in the study.

A total of 164 cases (72%) were diagnosed under ICD-10 code A09 for non-specific gastroenteritis of infectious etiology while 63 cases (28%) were diagnosed under ICD-10 code A06 for amoebiasis. There were no cases diagnosed under A00 for cholera and A03 for shigellosis.

Watery diarrhea was recorded as the presenting symptom in 116 cases (51%). No symptoms of bloody diarrhea were recorded. Other accompanying gastrointestinal signs and symptoms recorded include vomiting in 46 cases (20%), abdominal pain in 28 cases (12%). Fever was recorded in 32 cases (14%) while coughs and colds were noted in 23 cases (10%).

Table 1. Clinicodemographic Profile of Pediatric Patients with Acute Gastroenteritis

	n (%)
Infectious AGE cases / All pediatric consults	227 / 14471 (1.6)
Pre-pandemic, no of cases	179 (79)
Pandemic, no of cases	48 (21)
Age group, N (%)	
<6 months	7 (3)
6 – 11 months	25 (11)
1 – 3 years	100 (44)
4 – 5 years	32 (14)
6 – 12 years	42 (18)
13 – <19 years	21 (9)
Age, Mean (SD)	4.23 years (SD ±7.07)
Sex, no of cases	
Male: Female	127: 100
ICD-10 diagnosis, N (%)	
A09 (non-specific gastroenteritis of infectious etiology)	164 (72)
A06 (amoebiasis)	63 (28)
A03 (shigellosis)	0 (0)
A00 (cholera)	0 (0)
Signs and symptoms, N (%)	
Watery diarrhea	116 (51)
Vomiting	46 (20)
Abdominal pain	28 (12)
Fever	32 (14)
Cough and colds	23 (10)

Tables 2 and 3 show the frequency of medications prescribed and laboratories ordered for cases of infectious AGE. Table 4 shows the adherence of these interventions to the following identified statements with strong recommendations from the CPG.

The CPG strongly recommends zinc supplementation for all cases of infectious AGE except for patients less than six months of age. The seven cases of infectious AGE in pediatric patients less than six months of age were all prescribed zinc supplementation contrary to the recommendation of the CPG. Zinc supplementation was prescribed in 161 cases (73%) out of the 220 cases who were greater than six months of age.

Prescription of low-osmolarity ORS for volume replacement is strongly recommended in all cases of infectious AGE. In the rural SDN, only 119 cases (52%) out of 227 cases were prescribed with low-osmolarity ORS. On the other hand, around 5 cases (2%) were prescribed over-the-counter rehydration drinks that do not comply with the prescribed components of low-osmolarity ORS.

Prescription of specific probiotics *Saccharomyces boulardii* or *Lactobacillus rhamnosus GG* is recommended as adjunct therapy. While seven cases (3%) were prescribed with *Bacillus clausii,* no cases were prescribed with the recommended probiotics.

The CPG recommends against the use of loperamide and anti-emetics for symptom management of infectious AGE. All 227 cases (100%) were not prescribed any anti-emetics while 225 cases (99%) were not given loperamide. Other medications given for symptomatic relief include the anti-spasmodic dicycloverine for abdominal pain, which was given to 134 cases (59%) and paracetamol for fever control, which was given to 50 (22%) cases.

Ordering routine stool analysis and complete blood count, and prescribing empiric antibiotics for cases of infectious AGE with non-bloody diarrhea is strongly not recommended. Stool analysis was not ordered for 121 cases (73%) while CBC was not ordered in 116 cases (70%) in accordance to the CPG recommendations. Only 40 cases (24%) out of the 164 cases of infectious AGE with non-bloody diarrhea were not given antibiotics as recommended.

Lastly, the CPG recommends the use of appropriate antibiotics for cases of infectious AGE with bloody diarrhea or in cases with highly suspected or confirmed bacterial or parasitic causes. Sixty (60) cases (95%) out of the 63 cases of amoebiasis (ICD-10 code A06) were prescribed with metronidazole, the recommended antibiotic by the CPG.

Table 2. Frequency of Prescribed Medications

	No. of prescriptions (%)
Drugs recommended in the CPG	
Zinc	168 (74)
Low-osmolarity ORS	119 (52)
Metronidazole	101 (44)
Drugs NOT recommended in the CPG	
Dicycloverine	134 (59)
Cotrimoxazole	74 (33)
Paracetamol	50 (22)
Bacillus clausii	7 (3)
Non low-osmolarity rehydration drink	5 (2)
Amoxicillin-Clavulanic Acid	4 (1.7)
Cefalexin	3 (1.3)
Amoxicillin	3 (1.3)
Ciprofloxacin	2
Loperamide	2
Hyoscine	2
Cefuroxime	1

Table 3. Frequency of Laboratories Ordered

	No. of laboratory requests (%)
Stool analysis	57 (25)
Complete blood count	46 (20)
Hemoglobin and hematocrit	8 (4)
Urinalysis	6 (3)
SGOT	1
Abdominal ultrasound	1
Abdominal CT Scan	1

Table 4. Adherence to CPG Recommendations

CPG recommendation	Adherent cases / n* (%)
For all cases of Infectious AGE	
Children <6 months should not be given Zinc	0 / 7 (0)
Children >6 months should be given Zinc	161 / 220 (73)
Low-osmolarity ORS must be given for volume replacement	119 / 227 (52)
Probiotics (*Saccharomyces boulardii* OR *Lactobacillus rhamnosus GG*) must be given as adjunct therapy	0 / 227 (0)
Loperamide must not be prescribed	225 / 227 (99)
Anti-emetics must not be prescribed	227 / 227 (100)
For cases of non-bloody AGE with non-specific infectious etiology	
Routine stool analysis must be deferred	121 / 164 (73)
Routine complete blood count must be deferred	116 / 164 (70)
Routine antibiotics must be deferred	40 / 164 (24)
For cases of bloody AGE or those suspected with bacterial etiology	
Appropriate antibiotics must be prescribed	60/63 (95)

n = number of cases for which the recommendation is applicable

Cotrimoxazole, an antibiotic recommended as an alternative drug of choice for cholera was prescribed to 74 cases (33% of all cases), none of which were diagnosed under ICD-10 code A00 for cholera. Other antibiotics prescribed include amoxicillin, cefalexin, and ciprofloxacin, which were given singly to a total of 13 cases (5%).

DISCUSSION

The review of EMR yielded a low number of infectious AGE cases which could have been due to poor assessment approach and documentation practices. Adherence to the selected statements from the CPG are varied, ranging from total non-adherence (0%) to being completely adherent (100%). The rural SDN was noted to be more consistently adherent to statements concerning diagnostics than therapeutics, with low adherence to recommendations on rational antibiotic use and prescription of cornerstone therapies for infectious AGE.

Documentation of Infectious AGE cases

Altogether, the cases of infectious AGE identified amount to only 1.6% of all pediatric consults (N = 14,471). This percentage is low, especially when known incidences of acute infectious diarrhea in the pediatric population are taken into consideration. Studies done in Guatemala and Ethiopia, for example, show the incidence of infectious AGE to range from 11-15.84%.[11,12] It is notable, however, that a number of cases of watery diarrhea seen in the rural SDN were diagnosed under ICD-10 code K52.9. This ICD-10 code is reserved for cases of non-specific gastroenteritis of non-infectious origin and thus were excluded from the study.

Gastroenteritis in the pediatric population presenting as acute episodes of diarrhea is still infectious most of the time, coming from a range of viral, bacterial, and parasitic pathogens.[13] Reporting these cases under ICD-10 code A09 for non-specific gastroenteritis of infectious etiology in the EMR, unless with pertinent details in the history pointing otherwise, will help capture a more realistic frequency of infectious AGE in the rural SDN's pediatric population. In this study, while 164 cases were diagnosed under ICD-10 code A09 for non-specific gastroenteritis of infectious etiology, only 116 cases were recorded explicitly to present with watery diarrhea. This is despite the fact that watery diarrhea characterized by loose or frequent stools is a hallmark presentation of infectious AGE.[14]

The rest of the cases, on the other hand, were diagnosed under ICD-10 code A06 for amoebiasis, which is a known cause of bloody and mucoid diarrhea or dysentery.[15] A study done in Belgium showed that while a notable proportion of amoebiasis with E. histolytica can be asymptomatic, the presence of bloody diarrhea is a significant predictor for amoebiasis.[16] None of the 63 cases diagnosed with amoebiasis, however, were recorded to have presented with bloody or mucoid diarrhea.

These observations point to a possible lapse in history taking and physical examination, in the documentation of the pertinent findings, or both. While it is not included as an indicator for quality of care in this study, the CPG of choice still gives importance to the complete documentation of the patient's history and clinical presentation to guide the subsequent management goals for the patient. However, in a study done in Australia, adherence to recommendations on complete history taking and physical examination, and accurate documentation of findings was observed to be among the indicators with the lowest adherence at 16.8%.[17] A similar observation was made by a study done in Botswana where only 26% of diarrhea cases reached an acceptable standard for history taking, physical examination, and documentation.[18]

There was a decrease in infectious AGE cases seen during the pandemic period compared to the pre-pandemic period most probably resulting from the comparable decrease in the overall number of pediatric consults during the pandemic period compared to the pre-pandemic period. A significant drop in primary care consults is a phenomenon observed not only in our country but also in developed countries including China, Singapore, South Korea, and USA.[19] This drop in the number of consults is mainly attributed to the minimum health protocols and restrictions for social distancing put in place during the pandemic. Another factor that can be associated with this decline in consultations is the decrease in the funding for health services provided for by the rural SDN for most of the program's second year. This affected the rural SDN's capacity to provide basic services like free medications and laboratories, which could have discouraged consults at the rural SDN.

Majority of the cases (72%) belong to the under 5-year-old age group which reflect trends in the country and worldwide.[20,21] Infectious AGE is an especially important cause of morbidity and mortality in this age group and is the focus of major local and international initiatives promoting children's health and well-being.[3,21,22]

Judicious Laboratory Use

Adherence was relatively high to the recommendation against routine stool analysis and routine CBC in simple cases of infectious AGE with non-bloody diarrhea. Stool analysis can provide information with regard to the presence of parasitic ova and leukocytosis in stool samples. However, the low sensitivity, specificity, and positive and negative likelihood ratios of leukocytosis (set at >5/hpf) in stool samples cannot effectively differentiate between bacterial or viral etiology and thus is unnecessary in mild infectious AGE cases with non-bloody diarrhea.[23]

The same is true for complete blood count since the results can neither differentiate among etiologic causes nor influence the course of management.[4] It was notable that there was better adherence to these statements during the pandemic period, with 95% for the recommendation on stool analysis and 100% for the recommendation on CBC. While

this is a positive trend towards better adherence, this may be more attributable to the decrease in available laboratory services provided by the rural SDN due to lack of funding rather than actual change or improvements in the practice of ordering laboratories for infectious AGE.

Appropriate Adjunctive Therapy

Zinc supplementation is an important component of the management of infectious AGE for children greater than six months of age. It has been established to shorten the duration of diarrhea and reduce the risk of its persistence for greater than seven days.[24] In children less than six months, however, zinc administration has been shown to increase the risk of vomiting and the risk of diarrhea persisting beyond seven days. However, the two studies included in the meta-analysis upon which this recommendation was based were both done prior to developments in taste masking technology in oral pharmaceuticals, which could help reduce the risk for vomiting in more recent iterations of zinc supplements. Nonetheless, the current version of the CPG does not recommend the use of zinc supplementation for children less than six months. Given the importance of zinc supplementation in the management of infectious AGE, more effort must be exerted to increase adherence to its prescription recommendation, which is currently only at 73%.

Another adjunct therapy with strong recommendations is the prescription of either of the two probiotics specified: *Saccharomyces boulardii* or *Lactobacillus rhamnosus GG*. *Lactobacillus rhamnosus GG* have been shown to decrease the duration of infectious AGE by almost a day while *Saccharomyces boulardii* was shown to decrease the risk of diarrhea persisting for more than four days.[25,26] However, none of the cases seen in the rural SDN were prescribed with any of these probiotics. Notably, seven cases (3%) were prescribed with *Bacillus clausii*. *Bacillus clausii* is a popular choice in probiotics to be prescribed in cases of infectious AGE. Evidence on its use, however, is insufficient and was not recommended by the CPG.

The rural SDN was highly compliant to the recommendation against the prescription of loperamide and antiemetics. Loperamide is associated with serious side effects including ileus, lethargy, and death.[27] On the other hand, ondansetron was observed to be effective against vomiting, leading to a reduction of hospital admission rates for intravenous hydration. However, ondansetron is also associated with increased incidence of diarrhea.[28] The adherence to recommendations against symptomatic relief of vomiting is especially commendable considering the frequency of vomiting (20%) in the study population.

A drug frequently prescribed in the rural SDN is dicycloverine, an anti-spasmodic used to treat the symptom of abdominal pain. It was given to 134 cases (59%), which was more frequent than the prescription of low-osmolarity ORS. There is insufficient evidence, however, on its efficacy and safety for use in the pediatric population and is even contraindicated in children less than six months of age.

Low-osmolarity Oral Rehydration Salts

Replacement of fluid and electrolyte losses is the cornerstone of management in infectious AGE.[29] This is achieved through the administration of low-osmolarity ORS for mild cases of infectious AGE who can tolerate oral feeding such as the cases in our study population. A low adherence of only 52% for such an important component of infectious AGE management is concerning. This is comparable to the findings of a study done in Ujjain, India which showed low-osmolarity ORS being prescribed to only 58% of infectious AGE cases. In contrast, a study done in Bahrain showed a very high adherence rate of 89.3% when it comes to low-osmolarity ORS prescription in the primary care setting.[30] Increasing adherence to this recommendation is a good focus for high impact interventions against infectious AGE.

Rational Antibiotic Use

Infectious AGE is usually self-limiting and does not require antibiotic therapy in most cases. Indications for antibiotics include infectious AGE presenting with bloody diarrhea, fever, or more frequent loose watery stools which would lead to a higher suspicion of a bacterial or parasitic etiology.[31] In the rural SDN, 101 cases (44%) were prescribed with metronidazole while 74 more cases were prescribed with cotrimoxazole despite the fact that majority (72%) of the cases were diagnosed under ICD-10 code A09 for non-specific gastroenteritis of infectious etiology and does not require antibiotics. Furthermore, while symptoms of fever and bloody diarrhea can be indicative of a possible bacterial or parasitic etiology, only 14% of the study population presented with fever and no symptoms of bloody diarrhea were recorded. This would not justify the high frequency of antibiotic use. Adherence to the statement recommending against the use of empiric antibiotics in cases of infectious AGE with non-bloody diarrhea is concerningly low at 24%.

The same concern exists for antibiotic prescription patterns for AGE with bloody diarrhea or suspected specific bacterial etiology. Although there is a very high adherence to the statement recommending use of appropriate antibiotics for AGE with bloody diarrhea or suspected specific bacterial etiology, it is noticeable that the frequency of metronidazole prescription outnumbers the cases diagnosed under ICD-10 code A06 for amoebiasis. Furthermore, cotrimoxazole was prescribed for 33% of the cases even when no diagnosis of ICD-10 code A00 for cholera was made, for which it is an alternative drug of choice. This points to a practice of overprescribing and tendency for irrational antibiotic use by the rural SDN. Similar trends were observed by the study done in Ujjain, India where 71% of infectious AGE cases was prescribed an antibiotic.[32]

The inappropriate use of unnecessary antibiotics can lead to complications such as hemolytic-uremic syndrome,

relapses, and even persistent diarrheas, not to mention its significant contribution to antimicrobial resistance and increasing healthcare costs.[14] Measures to improve adherence to this important indicator will have a great impact both in improving outcomes and easing the socio-economic burden of infectious AGE.

Limitations

This study was based on a review of EMR and is limited by its inability to determine the degree to which the quality of documentation affects the observations made in the study. While inconsistencies in the assessment and diagnosis were pointed out, the study relies on the assumption that these diagnoses were correct to be able to make observations on the adherence of the management of these cases to recommendations from the chosen CPG.

CONCLUSIONS

Prescription and laboratory utilization patterns observed from the review of the EMR were used to determine the rural SDN's adherence rates to key recommendations from the CPG of choice. The SDN's low frequency of orders for diagnostic tests for infectious AGE resulted to a relatively high adherence to the recommendations regarding the judicious use of diagnostic tests. Other highly adherent practices such as the deferral of loperamide and anti-emetic prescriptions were countered by frequent prescription of non-evidence-based interventions, such as the frequent prescription of dicycloverine for abdominal pain relief. Prescription of metronidazole was also highly adherent to the CPG recommendation at 95%, however, patterns of antibiotic prescription of the SDN compared to the characteristics of the study population point to evidences of over prescription and irrational antibiotic use. On the other hand, frequency patterns and adherence rates to the prescription of low-osmolarity ORS for volume replacement as well as the prescription of zinc supplementation and appropriate probiotics were low despite being the cornerstone therapies of infectious AGE. While the rural SDN's adherence to judicious use of laboratories was relatively high, the low adherence to rational antibiotic use and prescription of appropriate cornerstone therapies for infectious AGE leave much room for improvement for the quality of care delivered by the rural SDN.

Recommendations

This study identified a few management practices that are commonly done in the rural SDN setting with little to no evidence evaluated yet and will be worth including for review in the next revision of the CPG. This includes the use of dicycloverine in the pediatric population for abdominal pain. In line with this, a review on the recommendation regarding the deferral of zinc supplementation for children less than six months of age is also warranted for the CPG's next iteration.

EMR reviews are easy and practical tools in assessing the quality of care rendered by a healthcare facility. However, results and assessment of these studies are highly affected by the completeness and thoroughness with which these records are completed by healthcare providers. Study designs that would be able to evaluate the rural SDN's approach to assessment and diagnosis of common diseases as well as the quality of their documentation will be useful in further interpreting the results of this study as well as in identifying points for improvement of the rural SDN's out-patient clinic system and EMR.

Prioritizing improvement of adherence to recommendations on the judicious use of laboratory tests, low-osmolarity ORS hydration, and rational antibiotic use will greatly help improve health outcomes and ease the socio-economic burden of infectious AGE.

Immediate education on the recommendations of the CPG, especially on the importance of low-osmolarity ORS for volume replacement and rational antibiotic use, is needed to improve adherence and ultimately the quality of care delivered by the rural SDN.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

All authors declared no conflicts of interest.

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APPENDIX

AGREE II Tool Scoring Sheet for the Appraisal of the 2019 Clinical Practice Guidelines on the Management of Acute Infectious Diarrhea in Children and Adults

Domain 1: Scope and Purpose
Item 1: The overall objective(s) of the guideline is (are) specifically described.
Item 2: The health question(s) covered by the guideline is (are) specifically described.
Item 3: The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described.

	Item 1	Item 2	Item 3	Total
Appraiser 1	7	7	7	21
Appraiser 2	7	7	7	21
Total	14	141	14	42

Maximum possible score: 42 Minimum possible score: 6
Scaled domain score: 100%

Domain 2: Stakeholder Involvement
Item 4: The guideline development group includes individuals from all relevant professional groups.
Item 5: The views and preferences of the target population (patients, public, etc.) have been sought.
Item 6: The target users of the guideline are clearly defined.

	Item 4	Item 5	Item 6	Total
Appraiser 1	7	7	7	21
Appraiser 2	7	7	7	21
Total	14	14	14	42

Maximum possible score: 42 Minimum possible score: 6
Scaled domain score: 100%

Domain 3: Rigor of Development
Item 7: Systematic methods were used to search for evidence.
Item 8: The criteria for selecting the evidence are clearly described.
Item 9: The strengths and limitations of the body of evidence are clearly described.
Item 10: The methods for formulating the recommendations are clearly described.
Item 11: The health benefits, side effects, and risks have been considered in formulating the recommendations.
Item 12: There is an explicit link between the recommendations and the supporting evidence.
Item 13: The guideline has been externally reviewed by experts prior to its publication.
Item 14: A procedure for updating the guideline is provided.

	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13	Item 14	Total
Appraiser 1	7	7	7	7	7	7	7	7	56
Appraiser 2	7	7	6	7	6	7	7	7	54
Total	14	14	13	14	13	14	14	14	110

Maximum possible score: 112 Minimum possible score: 16
Scaled domain score: 97.9%

Domain 4: Clarity of Presentation
Item 15: The recommendations are specific and unambiguous.
Item 16: The different options for management of the condition or health issue are clearly presented.
Item 17: Key recommendations are easily identifiable.

	Item 15	Item 16	Item 17	Total
Appraiser 1	7	7	7	21
Appraiser 2	7	7	7	21
Total	14	14	14	42

Maximum possible score: 42 Minimum possible score: 6
Scaled domain score: 100%

Domain 5: Applicability
Item 18: The guideline describes facilitators and barriers to its application.
Item 19: The guideline provides advice and/or tools on how the recommendations can be put into practice.
Item 20: The potential resource implications of applying the recommendations have been considered.
Item 21: The guideline presents monitoring and/or auditing criteria.

	Item 18	Item 19	Item 20	Item 21	Total
Appraiser 1	6	7	7	7	27
Appraiser 2	6	7	7	7	27
Total	12	14	14	14	54

Maximum possible score: 56 Minimum possible score: 8
Scaled domain score: 95.6%

Domain 6: Editorial Independence
Item *22: The views of the funding body have not influenced the content of the guideline.*
Item 23: Competing interests of guideline development group members have been recorded and addressed.

	Item 22	Item 23	Total
Appraiser 1	7	7	14
Appraiser 2	7	7	14
Total	14	14	28

Maximum possible score: 28 Minimum possible score: 4
Scaled domain score: 100%

Overall Guideline Assessment

Rate the overall quality of this guideline
Appraiser 1: 7
Appraiser 2: 7

Would you recommend this guideline for use?
Appraiser 1: Yes
Appraiser 2: Yes