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Analysis of pharmacist-based medication management for children with medical complexity

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ABSTRACT

Coordinating care for children and youngsters with specialized health care requirements and Medical Complexity (MC), particularly Medication Management (MM), poses significant challenges for providers, caregivers, and children. This research outlines the creation of a clinical pharmacotherapy performed in a pediatric long-term Healthcare Capacity (HCC), the implementation of standard procedures for Comprehensive Medicine Management (CMM), and the formation of a Cooperative Practice Arrangement (CPA) to direct the administration of drugs. A prospective case study includes 100 patients identified as MC in this HCC quality enhancement initiative during an 8-month duration.

Medical Pharmacists (MPs) detected, averted, or resolved 1400 treatment problems, averaging 12 treatments per participant. The patients had an average of 9.8 complex chronic medical issues and a median duration of stay of 78 years. The mean number of medications per patient decreased from 25 to 22. A pharmacoeconomic evaluation of 245 therapies indicated an average direct cost reduction of $45k ($450 per patient per month) and a monthly cost prevention of $49k ($490 per patient per month). Twenty-eight emergency department admissions and sixty-one clinic and emergency room visits were averted. Hospital readmissions decreased by 45%. MPs' suggestions achieved a 95% acceptance rate. Using a CPA to perform CMM in MC diminished pharmaceutical burden, addressed and averted problems, lowered healthcare-related expenses, decreased hospitalizations, and was effectively embraced and cooperatively executed with HCC physicians.

Keywords: *Pharmacist, Medication Management, Children, Medical Complexity.*

1. INTRODUCTION

Children and youths with specialized healthcare requirements and Medical Complexity (MC) have various severe chronic health disorders that impact several organ systems, leading to functional restrictions, elevated healthcare requirements or usage, and frequently necessitating the use of medical equipment [1] [18]. An instance of this is a child who suffered diminished oxygenation to the brain throughout birth, leading to hypoxic-ischemic dementia, and now endures epilepsy, breathing problems necessitating tracheostomy and ventilatory therapy, dependence on a feeding tube, overbearing secretions, cortical deafness, and endocrine disorders. These patients encounter numerous unmet requirements, particularly among sub-populations impacted by multiple illnesses and compounding. These patients constitute over 32% of pediatric medical expenses, although they comprise approximately 2% of the pediatric community.[2] Various strategies have been implemented recently to enhance access to healthcare and mitigate adverse events, such as patient-centered medical residences, telecommunications- and multidisciplinary teamwork, among other people; however, the routine application of pediatric medical support for Comprehensive Medicine Management (CMM) is still not a significant focus [9] [17].

1.1 Care Management Models in Pediatric Patients

Complex chronic conditions are characterized as any illness that is anticipated to persist for a minimum of 12 months (barring death) and that affects numerous organs or a single organ structure to such a degree that it necessitates specialized pediatric treatment and likely requires periods of hospitalization in a higher-level medical facility [3]. Twenty children and youth with exceptional health care needs and complex medical illnesses frequently present numerous complex chronic ailments, requiring comprehensive care plans that incorporate multiple drugs, diverse subspecialty engagement, and reliance on technology, complicating the release process to homes [4].

MC is transitioned to pediatric long-term Healthcare Capacity (HCC), where a fresh group of doctors, specialist suppliers, healthcare professionals, and respiratory therapy professionals is necessary to organize debates with sub-specialists and evaluate medication administration concerns, particularly during changes in care [13] [14]. An assessment of admission drug reconciliation in MC at a hospital indicated elevated rates of erroneous prescriptions in over fifty percent of patients. The

offering of Comprehensive drug Administration or drug treatment oversight by Medical Pharmacists (MPs) has been recognized as a service that will likely benefit Children and Youth with Special Health Care Needs (SHCN) and Complicated Medical Conditions, significantly reducing the complexity of prescription regimens [5] [6].

1.2 Pharmaceutical Therapy Issues in Children

Children and Youth with Chronic MCs frequently have hospitalizations, are prescribed multiple drugs, and are at an elevated risk for Adverse Drug Responses (ADRs) [11]. Pediatric individuals who have at least a single complicated chronic disease are roughly five times more likely to need emergency department services related to ADRs. Elevated incidences of preventable adverse drug reactions recognized by Comprehensive Medication Management upon hospitalization have been documented in Children and Youth with SHCN - Children with MC, especially among those administered a minimum of five chronic drugs. [15]

Polypharmacy is a recognized issue within this demographic, as numerous Children and Youth with SHCN and MC are often subjected to chronic daily drugs (fewer than five medicines) characterized by intricate schedules that encompass various therapeutic categories and involve high-risk pharmaceuticals. Polypharmacy elevates the likelihood of drug-drug interactions and resultant potential ADRs, particularly in adolescents with over three severe chronic diseases. The prevalence of ADRs is influenced by the significant utilization of off-label and illicit drugs in children and adolescents.

1.3 Hospital Readmissions (RA) and Financial Mitigations

Hospital RA constitutes the predominant portion of future expenses following an initial hospitalization, prompting payers to focus on this indicator to mitigate superfluous healthcare expenditures [7][8]. Thirty-day hospital RA rates for pediatric patients with complicated chronic diseases range from 12% to 45%, contingent upon medical intricacy and technology reliance. The quantity of discharge medicines and intricate chronic diseases in MC correlates with hospital RAs.

Avoidable expenditures in MC within the outpatient context are not limited to hospital RAs. Direct reductions in expenses, or "hard costs," can be realized by initiatives like the cessation of an unneeded drug or test in the laboratory. Cost prevention, or "soft expenses," denotes the potential savings that would have been realized had a prospective ADR not been minimized or avoided. The financial implications of MPs strategies for reducing expenses in pediatric ambulatory medical clinics have been delineated but not within the place context.

The present case series aims to delineate a children's pharmacotherapy practice centered on delivering CMM via a Collaboration Practice Agreement (CPA) to children acknowledged to a pediatric HCC with challenging MC [16]. It seeks to characterize this prone patient demographic and pharmacotherapeutic measures, determine the savings in expenses and cost avoidance linked to MPs' participation, and assess the influence of MPs' involvement in an HCC on hospital RA rates.

2. TECHNIQUES AND RESOURCES

2.1 Description of the Pediatrics MPs Team

Enhancing Peds is a consulting pharmacy organization owned and controlled by pediatric MPs, comprising seven proficient child MPs with over 72 years of cumulative expertise in pharmaceutical therapy administration, drug knowledge, and patient counseling. The Doctor of Pharmacy personnel at Enhancing Peds have either become Boards Certified Child Pharmacotherapy Experts or have undergone partial or entire residency education in a child environment. Numerous individuals are worldwide and nationally acknowledged for their services to child pharmacy education and are extensively included in pediatric journals. Perfecting Peds is engaged in various pediatric care environments, such as HCC, medical preschools, acute care rehabilitation centers, and ambulatory hospitals, and provides services for home-based individual customers.

2.2 Targeted HCC Descriptions

This suburb HCC obtains patient requests from prominent pediatric facilities within a four-state area. This place offers expert healthcare, rehabilitative services, and respiratory treatment and handles complexities related to expansion, growth, and schooling that the child's healthcare vulnerability exacerbates [10] [12]. The prescribing team at this particular HCC comprises one board-approved child pulmonologist and two experienced clinicians with significant knowledge of managing HCC individuals. The care team includes doctors and respiratory therapy professionals. The pharmacy amenities at the institution have traditionally been restricted to a weekly pharmacy visit to assess expired medicines, conduct narcotic determines, oversee drug administration, and ensure compliance with state pharmaceutical rules.

2.3 Protocol Overview

A retrospective case series approach was utilized to examine child MP treatments for children and youth with SHCN and CM conditions in a freestanding pediatric long-term care facility. Every child MP established a CPA with the institution's doctors and acquired a CPA state license. The CPA permitted specific pre-approved treatments without consulting the prescribing supplier. At the same time, additional measures necessitated a meeting between the provider and pharmacy

technician (e.g., the MPs could modify the weight on a medicine called PRN requests with no prior approval but needed approval for adjustments to a sleeping pill taper).

Participants were enrolled in the present investigation if they had been taken to the place throughout the study term. They provided permission from their parents or guardians for involvement in the CPA, which was secured. Patients failing to satisfy the inclusion requirements were removed.

ADRs were monitored and classified in two methods:

1. ADR tracking: the MPs recognized the absence of specific surveillance strategies necessary for the secure handling of medications and advised implementing such plans to avert ADRs (e.g., individuals on psychotropic drugs lacking metabolic panel tracking).

2. ADR management: the MPs determined that a particular ADR likely arose due to a drug, using drug dosing citations, primary research, and clinical expertise. The MPs talked with the doctor, nursing staff, and consultant physicians to evaluate the probability of causation. All ADR-managed incidents were collectively assessed by the group as supplementary to the drugs, prompting the implementation of a plan to address or handle the ADR (e.g., administering clonidine at six-hour intervals for autonomic bursting and behavioral disorders while managing hypotension required dose withholding).

It assesses the intervention's effects and has been executed to reduce the interval and evaluate cholesterol levels, respiration, and bouts of agitation to elucidate the intricacy of HCC citizens; each patient's current codes were assessed to classify and quantify illnesses identified as complicated chronic disorders.

The digital medical record was examined for the inclusion criteria to generate a data analysis. This analysis was utilized to gather information on demographics, the number of medicines administered pre- and post-discharge, and the amount and types of treatments by manually reviewing the current medical records. All treatments were recorded in an MP note for the patients participating in the trial.

The intervention categories were pre-established and categorized as clinical procedures or reconciliation of medication treatments. The precise categories of clinical treatments encompass dosage modification, frequency alteration, therapeutic change, laboratory tracking, examination monitoring, documented interactions (food or drug), prior approval, and patient education. These actions guaranteed that people's drugs were clinically effective, safe, and customized to their clinical conditions.

The precise reconciliation of medicines procedures, including dosage modification, frequency alteration, adding of omitted medications, removal of finished medications, re-entry of drugs for further data, and inclusion of ADRs or allergies. The objective of the drug reconciliation treatments was to verify that the drug list in the electronic health record accurately corresponded with the release summary and departure instructions. The result was examined for any hospital admission or emergency department visit within 30 days post-discharge.

The recipient's discharge prescription list, including dosage form, rate, and supplementary instructions, was used to compute a rating. The rating was calculated using the Microsoft Access Version 1.0 data collection tool the University of Medicine and Pharmaceutics created.

The data were examined evocatively using the median and interquartile range (25%-75%). Ongoing variables were evaluated using the Wilcoxon rank-sum examination, and the connection was assessed using Pearson correlation coefficients. A p-value of 0.05 was deemed to have statistical significance.

3. RESULTS

3.1 Demographics

Table 1. Demographic analysis

Variable		Data
Gender	Girl	45
	Boy	55
Age (average) (yrs)	Girl	4.93
	Boy	4.52
Hospital stay (days)	Girl	1.5
	Boy	6.1
Communicative method (%)	Phone	79
	In person	11
	Message	5
	Telehealth	5

Discharging average	Girl	12.5
	Boy	23.1

An aggregate of 130 clinic sessions were selected for consideration. Thirty-six patients (29.5%) were removed due to either not attending the primary care appointment for CMC or lacking a discharge assessment performed within 8 days. The present research includes 91 clinic interactions involving 70 individuals. Most participants were male (64%), with an average age of 8 years. The typical duration of stay was 3.5 days, and the participants had an average of 19 drugs on their last prescription list. The average rating was 58.5, ranging from 10 to 140.8 (see Table 1).

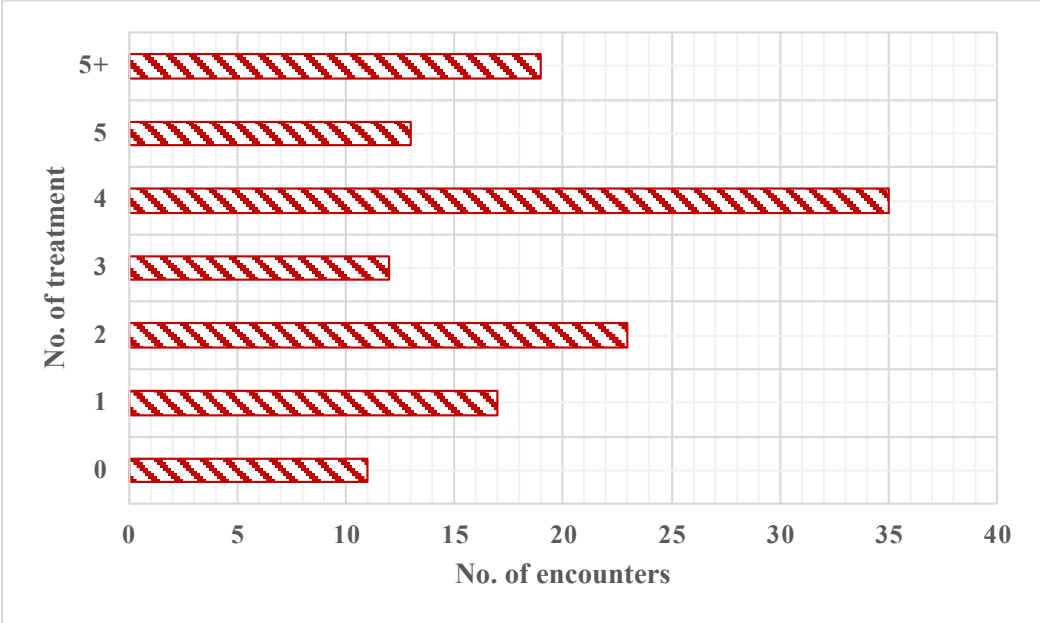

Figure 1: Treatment per encounter analysis

3.2 Pharmaceutical Treatments

Two hundred eighty-three treatments were conducted throughout 91 clinic experiences, with 194 (67%) categorized as surgical procedures and 92 (34%) classified as reconciling medication treatments. The mean number of treatments per patient interaction was 4 (0-14) of 90 patient contacts, and 81 (87%) involved at least one pharmacy worker treatment (Figure 1). Training constituted the predominant clinical treatment, with 64 instances (32%) (Figure 2). The predominant drug reconciliation strategy involved removing medicine from the list, comprising 42 treatments (41%) (Figure 3).

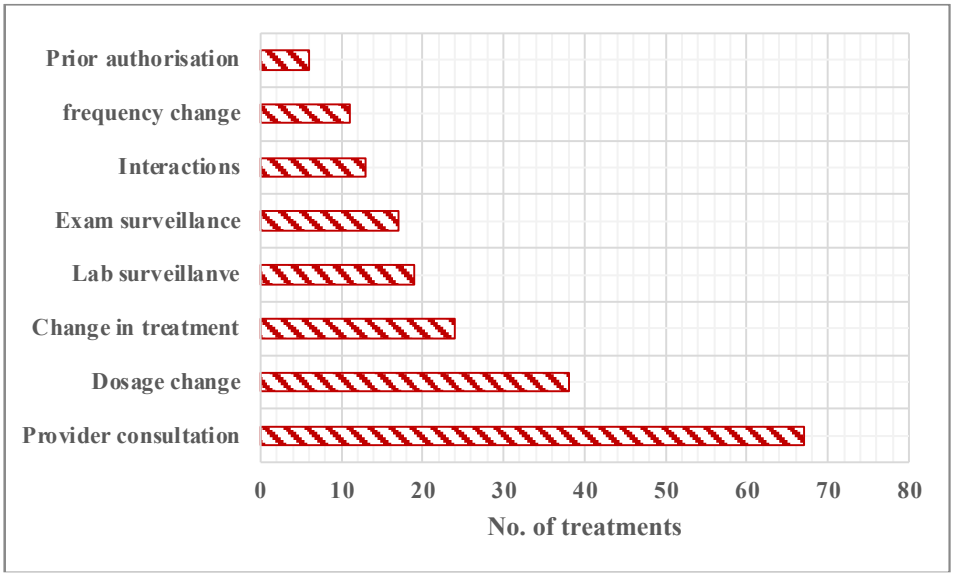

Figure 2: Treatment amount analysis

3.3 Correlation between Score and Re-admission Rates

Of 90 clinic contacts, 30 encounters (35%) resulted in either an emergency department visit, an inpatient enrollment, or both within the 30 days following release. There was no significant difference between the mean values of readmitted individuals compared with those who had not been readmitted (61.5 vs. 57.3, p = 0.58), suggesting that elevated ratings were not correlated with RA instances in the present research (Table 2).

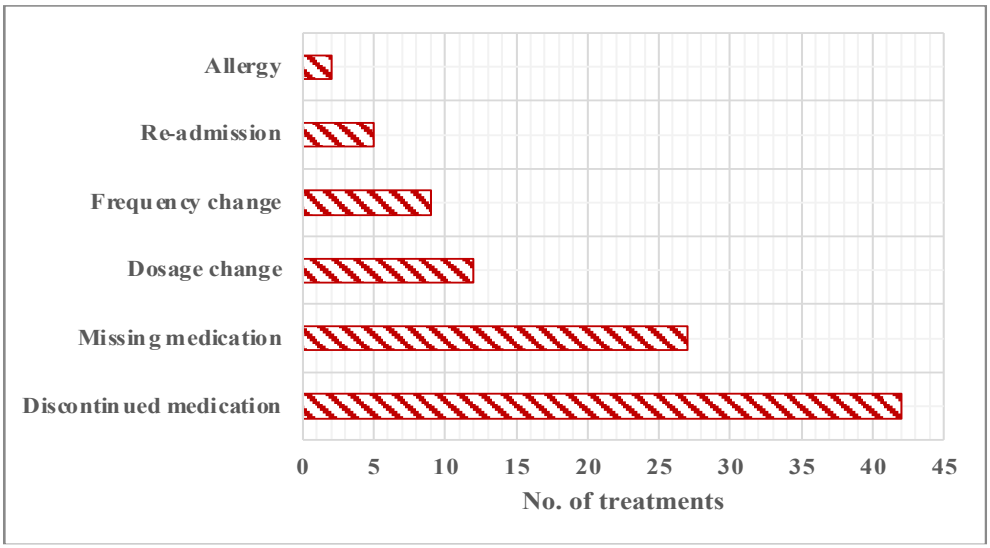

Figure 3: Treatment reconciliation analysis

3.4 Correlation between Score and Treatment Categories

The association between the rating and the number of clinical treatments was 0.25 (p = 0.42), whereas the relationship between the rating and the number of drug reconciliation treatments was 0.24 (p = 0.194). The connection between the duration of stay and the number of treatments was 0.198 (p = 0.025), indicating a relationship whereby an extended length of stay corresponds with a higher number of medical treatments.

Table 2. Correlation HCC analysis

Readmissions	No of participants	Mean score	P value
No	61 (63.1%)	57.2	0.356
Yes	39(36.9%)	61.3	-

4. PILOT OUTCOMES

The analysis of the MPs' principal outcome and duration spent on finishing Drug Utilization Reviews (DMR). The MPs dedicated a mean of thirty minutes to each DMR completion. Therapeutically complex patients required a median of 45 minutes to complete DMR, whereas non-medically complicated individuals took 16.5 minutes. In the epilepsy category, a median of 40.2 minutes was utilized to complete DMR.

Most MP's time was allocated to completing DMR in the Electronic Medical Record (EMR), averaging 15 minutes for each discharge, and addressing outpatient drugstore or insurance difficulties, averaging 5.9 minutes per departure. The MPs recorded 890 treatments throughout the study. The interventions comprised 12 pharmaceutical education sessions (12.4%) and 78 revisions of discharge medications (89.1%). Numerous patients necessitated multiple clarifications regarding their discharge medication, resulting in a significant volume of pharmacy treatments. In total, 63.1% of patients necessitated an intervention.

MP treatment was required in 88% of clinically complex patients, in contrast to 49.2% of non-medically tricky individuals. In the epilepsy category, 91.4% of individuals necessitated MPs treatment. The predominant intervention kinds were therapeutic improvement (30.5%) and change of instructions (31.5%). Therapeutic improvements often pertain to medication and indication. At the same time, instruction modifications primarily involve frequency adjustments—information concerning the treatments executed by the MPs throughout this pilot and an evaluation of the suggestions.

The overall projected cost avoidance throughout the pilot research was $85k. The predominant intervention group was the avoidance of mild ADEs, with 67 treatments. A medication-related issue was detected within 15 days post-discharge. The situation pertained to a hydrocortisone taper for which the individual and household were given MP-led instructions and a prescription calendar before discharge; however, the patient's guardian necessitated further clarification through a phone

consultation over the prescribed dosage taper. No medication-related RAs were detected. The aforementioned medication-related issue occurred within the epilepsy category, resulting in a 5.1% rate of medication-related difficulties (1 out of 29 patients).

The pre-pilot student questionnaire was disseminated to 50 medical inhabitants, with 22 residents completing it, resulting in a 39.4% response rate. Residents recognized patients hospitalized for epilepsy (36%) and cancer (36%) services as the most difficult to manage DMR. The predominant challenges in performing DMR were time constraints (37%), difficulties with the EMR (21%), and lack of knowledge of drugs (21%). Among the pre-pilot poll respondents, 22% expressed confidence in the accuracy of DMR completion, 22% indicated satisfaction with the DMR management, and 91% confirmed or concurred that MPs-driven DMR would improve how they work.

Ninety percent of residents concurred or strongly concurred that DMR is a valuable residency skill, whereas thirty-five percent deemed resident instruction on DMR sufficient. Ninety-five percent of locals believed that supplementary support for DMR was necessary. The post-pilot student questionnaire was administered to 11 medical students in the general pediatric department throughout the MPs-led DMR pilot. Eight residents, constituting 70.8%, answered the post-pilot survey.

Most people indicated dedicating between zero and one hour daily to DMR over the two-week pilot period, excluding pilot times. Researchers noted that patients hospitalized in the epilepsy department (45%) or those discharged with more than three drugs (55%) derived the most advantages from physician DMR. All residents concurred or strongly concurred that the DMR was executed precisely, and all expressed satisfaction with the DMR process throughout the pilot. Participants identified weekend release (66.1%) as the predominant reason for not utilizing pharmacy services.

5. DISCUSSIONS

Medication regimens are frequently modified throughout the process of moving from home to hospital and from hospital back to home, hence elevating the risk of medication mistakes and ADEs. Numerous institutions have established standards and policies to facilitate secure changes, with MPs spearheading the initiatives.

MPs possess the clinical expertise and competencies that enable them to facilitate the reconciliation of medications and transfers of care effectively. A study indicated that drug histories acquired by MPs were more precise and comprehensive than those gathered by physicians. The American Association of Health-System MPs pharmacy science anticipated that pharmacy technicians would assume a more significant role in the healthcare process changes and engage more actively in managing individuals with intricate medication-related requirements to facilitate optimum medical results.

The primary emphasis in the pediatric context has been moving from home to hospitalization. Patients with Chronic Medical Conditions (CMC) constitute a susceptible demographic that encounters medication mistakes or ADEs due to their frequent contact with healthcare services and intricate medication schedules, particularly during transitions from home to inpatient and vice versa. This study illustrates an MP's role in the departure drug reconciliation procedure during transfers from hospital to home. The main aim of this study was to measure and categorize the actions performed by the MPs throughout the release of medication assessment.

Within 125 days, 83 (88%) of clinic encounters involved at least one MP's treatment, while 34 (37%) involved a minimum of four treatments. While the primary care MPs executed these treatments, this role might be extended to inpatient MPs to guarantee safe and effective therapy before patient departure.

The secondary aims of this study were to investigate the correlations among scores and RA rates, as well as pharmaceutical interventions. This investigation did not reveal a substantial disparity in grades and RA rates within this sample. This data contrasts with research, indicating elevated scores correlate with increased RA rates. This is attributable to various factors. Of 90 clinic contacts, 34 (39.5%) led to inpatient RA. MPs' participation in the discharge reconciliation of medications has influenced RA rates, even though there was no variation in ratings.

Children with CM conditions constitute a distinct patient demographic and utilize medical services more frequently than general pediatric people, potentially leading to elevated RA rates. The measure is validated for humans and has been used in pediatrics; however, many elements of pediatric pharmaceutical regimens are not considered in the score, undermining its validity in pediatric patients. Some aspects of drug regimens in CMC that the current score does not address encompass the administration of drugs via tubes for feeding, the utilization of compounded drugs, and the requirement for ketogenic-friendly (lower carbohydrate) medications for individuals adhering to a ketogenic diet for neurological diseases. These are a few aspects that augment the complexity of pharmaceutical regimens in juvenile patients. A pediatric-specific instrument should be created to enhance the evaluation of this patient demographic.

Although a significant link between rating and the type of MP intervention was absent, a post hoc examination revealed a clear correlation between the prolonged length of stay and the frequency of medical treatments. This link indicates that individuals with an extended stay are a target demographic for pharmacies to conduct a discharge prescription assessment to guarantee safe and optimum care. Despite the small link shown, subsequent studies should ascertain the existence of a stronger correlation.

This study contributes to the scarce literature about MPs' participation in assessing child discharge medications. The distinctive group of patients constitutes a significant strength of this investigation. This research, nevertheless, has several drawbacks. The retrospectively single-center approach and limited sample size restrict the applicability of results to other universities. The grading instrument employed in this investigation was developed and tested exclusively for adults and did not adequately address pediatric pharmaceutical regimens' complexities. The investigation lacked an equivalent group, limiting the ability to ascertain the MP's impact on different patient groups. The research's short period obscures the results, as the pandemic could have affected hospitalizations and emergency room visit statistics.

6. CONCLUSION

The present research demonstrated that MPs' participation in patients' discharge drug reconciliation led to several treatments that enhanced precision and optimized the patients' prescription regimes. Pharmacies are educated to recognize and resolve drug-therapy issues, qualifying them for this post. No correlation was observed between elevated ratings and the frequency of pharmaceutical treatments, nor between higher ratings and RA rates. The research introduces a potential case series employing a standardized methodology for patients with MC via a CPA. Employing a CPA to perform CMM in MC diminished pharmaceutical burden, alleviated problems, lowered costs, decreased RA rates, and was effectively accepted and executed in partnership with HCC physicians. Many possibilities exist for enhancing clinical care delivery for MC, and pediatric-trained chemists are ideally equipped for this role.

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