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# EXPLORING THE COMPLEXITIES OF POLYPHARMACY IN PEDIATRIC PATIENTS IN SECONDARY CARE HOSPITAL

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## ABSTRACT

To retrospectively analyse the prevalence and patterns of polypharmacy in Pediatrics. Electronic health data of pediatric patients aged 0 to 18 admitted between Jan and Dec 2024 were collected. Patient demographics, commonly prescribed drugs, routes of administration, and the type and number of comorbidities were assessed by Statistical approaches like the One-Way Anova Test, Correlation Analysis, Regression Analysis, and Descriptive Analysis. Among 134 cases, patients with polypharmacy and comorbidities were examined. The most commonly used medications were Pantoprazole, Ondansetron, and Paracetamol, with the intravenous route being the most frequently administered, followed by the nasal and oral routes. It also evaluated comorbidities, revealing that 32% of patients with Lower Respiratory Tract Infection (LRTI), 39% with Acute Febrile Illness (AFI), and 20% with Bacillary Dysentery had additional comorbidities. ANOVA results ($F = 11.87$, $p = 0.00013$) and Correlation Analysis highlight that polypharmacy is not random but systematically linked to comorbidities. Regression analysis was also conducted to predict the number of diseases based on the number of comorbidities and medications. This study highlights the extensive use of multiple medications in pediatric care and its link to comorbid conditions, stressing the need for better prescribing practices to enhance treatment effectiveness and reduce risks.

**KEYWORDS:** Polypharmacy, Paediatric Patients, Comorbidities, Retrospective Analysis.

## INTRODUCTION

Polypharmacy, defined by the World Health Organization (WHO), refers to a patient's concurrent use of multiple medications, typically five or more.[1] This issue is increasingly prevalent in pediatric populations, especially among children with medical complexity (CMC). CMC often requires numerous medications to manage various chronic conditions, resulting in a higher incidence of polypharmacy.[2]

In a 2023 article published in The Lancet, it is mentioned that a lack of coordination could result in unnecessary or possibly detrimental prescriptions due to specialists not having complete access to a patient's medication history.[3] Furthermore, the inclination to recommend medications for symptom control instead of treating the underlying cause of illnesses can worsen polypharmacy.[4,5]

Several factors contribute to the high prevalence of polypharmacy among children and adolescents:[6]

**Chronic Health Conditions:** Children with chronic conditions like asthma, attention-deficit/hyperactivity disorder (ADHD), depression, and diabetes often need daily medications. Managing these conditions plays a significant role in the widespread use of polypharmacy in pediatric populations.[7]

**Life-Limiting and Life-Threatening Conditions:** Pediatric patients with life-limiting illnesses, such as certain neurological, respiratory, or metabolic disorders, often require multiple medications to address their complex health needs. Research indicates that a large number of these children are prescribed five or more different medications each year.[2]

**Medical Complexity:** Children with medical complexities (CMC) often have multiple comorbidities and require extensive healthcare services. This increased complexity leads to polypharmacy, which is associated with potential negative effects, medication errors, and an added burden on caregivers.[8]

**Psychotropic Medication Use:** Children and adolescents who display severe behavioral challenges are frequently prescribed psychotropic medications. The use of multiple psychotropic drugs, or psychotropic polypharmacy, is especially common in this group, raising concerns about safety and effectiveness.[9]

**Overprescription and Lack of Medication Review:** In some instances, medications are prescribed without proper review, resulting in overmedication. This often occurs due to inadequate medication reconciliation processes and poor coordination between healthcare providers.[7]

While polypharmacy is sometimes necessary for addressing complex health needs, it presents substantial risks, including adverse drug interactions, medication errors, and difficulties with adherence. The intricate medication regimens often required for CMC necessitate vigilant medication therapy management to mitigate these risks. Pharmacists are integral to this process, conducting thorough medication reviews and offering interventions to optimize treatment outcomes. Although polypharmacy is essential in some cases, excessive use can lead to serious concerns, such as adverse drug reactions (ADRs), medication errors, and increased healthcare costs.[10]

**Key Risks Associated with Pediatric Polypharmacy**

**Adverse Drug Reactions (ADRs):** Children taking multiple medications are at a heightened risk for ADRs, which may result in emergency department visits or hospitalizations.

**Medication Administration Errors:** The complexity of medication regimens increases the likelihood of administration errors, including overdosing, underdosing, or missed doses.

**Increased Healthcare Utilization:** Polypharmacy is linked to higher rates of hospitalizations and emergency visits due to ADRs and medication-related issues.

**Off-Label Drug Use:** The frequent use of off-label drugs in polypharmacy poses risks, as there is limited pediatric data on their safety and effectiveness, raising the potential for adverse events.

Addressing polypharmacy in pediatrics requires a coordinated approach involving healthcare providers, patients, and families to ensure that the benefits of medications outweigh the potential harms. A study published in JAMA Internal Medicine (2022) discovered that organized interventions for deprescribing, especially those utilizing various team members, successfully decreased medication load and enhanced patient results.[11] Deprescribing programs frequently require thorough medication evaluations and involve patient-centered decision-making to guarantee safe and appropriate discontinuation.[12] By implementing thoughtful prescribing, regular medication reviews, and patient education, the risks associated with polypharmacy can be effectively minimized, leading to safer and more effective pediatric care. Drug utilization evaluation (DUE) plays a crucial role in assessing and improving medication use in polypharmacy.[13] The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) (1994) defines DUE as a continuous and systematic process designed to ensure the appropriate and efficient use of drugs.[14] By incorporating DUE in polypharmacy management, healthcare providers can identify potentially inappropriate medications, reduce adverse drug events, and optimize therapeutic outcomes.

This research paper will examine the challenges of polypharmacy in children by applying statistical methods to analyse electronic data, including demographics, routes of administration, commonly used medications, and comorbidities.

## MATERIALS AND METHODS

**Data Sources:** Electronic health data of Pediatric children aged 0 to 18 years old who were admitted to a Secondary Care Hospital between January and December 2024 were collected.[15,16]

**Population:** 134 Pediatric patients on >4 medications, excluding incomplete records or surgical/emergency cases.

**Data Collection:** Analyzed 134 cases of all categories using hospital records for understanding the demographics, commonly prescribed medications, routes of administration, and prevalent comorbidities in this group is essential for optimizing therapeutic strategies and minimizing potential risks.

**Parameters Recorded:** Data on diseases, comorbidities, and prescribed medications.[17]

**Statistical Techniques:** Statistical approaches were used to assess patient demographics, commonly prescribed drugs, routes of administration, and the type and number of comorbidities found. Statistical techniques like Descriptive and inferential Statistics, including ANOVA & Correlation Analysis, Regression, and Variance Analysis, are used to analyze the collected data to look for the Prevalence and pattern of Polypharmacy in pediatrics. [18-20]

## RESULT AND DISCUSSION

### 1. Patient Demographics

This retrospective study analyzed data from 134 patients, of which 76 were male and 58 females. The age distribution of the patients is categorized in (Table no 1) and we found that 29 males and 27 females are infants. Among the children, 24 males and 17 females are young children, and 11 males and 9 females are in middle childhood. The adolescent group includes 12 males and 5

females and Analysis of hospital records from the past year revealed a disproportionately high admission rate among infants and young children admission rate among infants and young children. and young children represent 70% of the Patient Population. 38 % of the patients are infants and 32 % are young children.

**Table 1: Patient demographics.**

| Population Category | | Age | Male | Female |
|---|---|---|---|---|
| Infants | | 0-12m | 29 | 27 |
| Children | Young Children | 1-5yr | 24 | 17 |
| | Middle Childhood | 6-9yr | 11 | 9 |
| | Adolescent | 10-19yr | 12 | 5 |

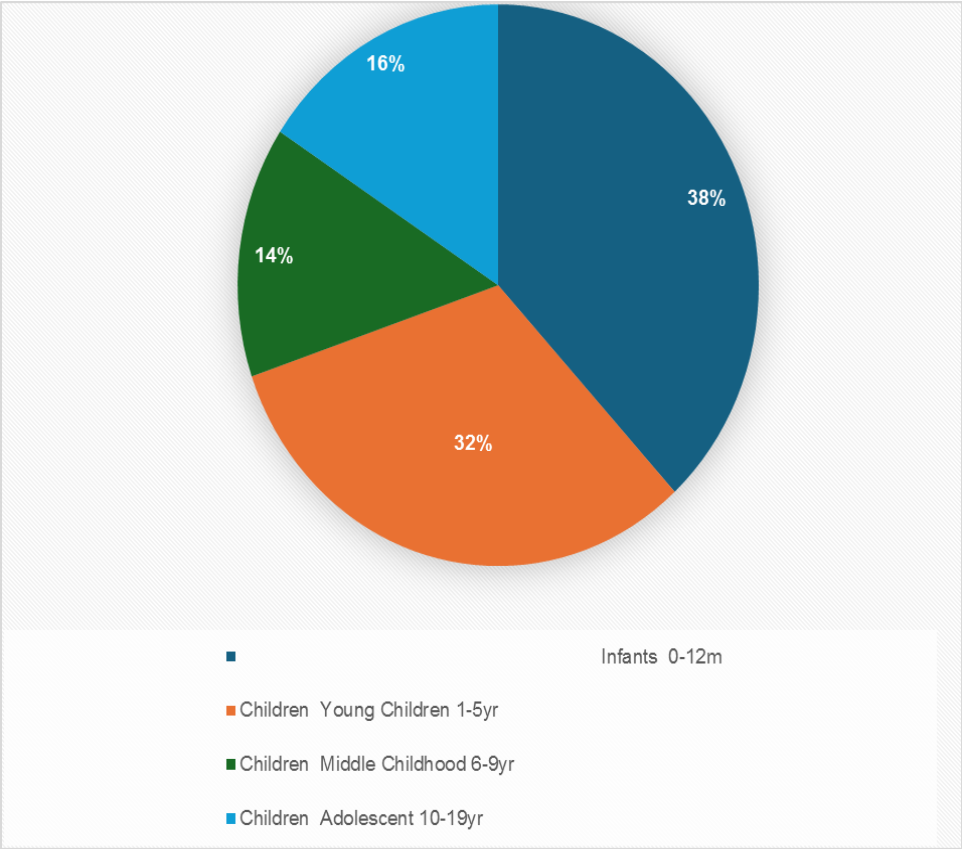


**Fig. No. 1: Distribution of hospital admissions by age group.**

This trend is clearly illustrated in Graph No.1which presents the percentage of hospital admissions within these age groups. Showed that infants and young children represent 70% of the Patient Population. 38 % of the patients are infants and 32 % are young children.

**2. Disease Case and Treatment Matrix**

We did a statistical analysis of patient data, which revealed a significant degree of clinical complexity marked by a high average number of diseases per patient (9.33) and a substantial medication burden (21.17 medications on average).

**Table 2: Count of overall data collected.**

| Type of disease | No. of Cases | No. of comorbidity | No of medication |
|---|---|---|---|
| Acute Febrile Illness | 23 | 9 | 43 |
| Bacillary Dysentery | 3 | 1 | 15 |
| Dengue | 13 | 3 | 45 |
| Digestive Disease | 15 | 4 | 31 |
| Febrile Seizure | 10 | 1 | 26 |
| Lower Respiratory Tract Infection | 28 | 9 | 28 |
| Malaria | 3 | 1 | 9 |
| Neonatal Hyperbilirubinemia | 5 | 1 | 7 |
| Neonatal Jaundice | 3 | 1 | 7 |
| Urinary Tract Infection | 2 | 0 | 13 |

| | | | | |
|---|---|---|---|---|
| Tetany | 2 | 1 | 10 | |
| Respiratory Distress | 5 | 0 | 20 | |
| Total | 112 | 31 | 254 | P=0.0001*** |

*p<0.05, ***p<0.0001, Between the groups (No. of cases, No. of comorbidity, No. of Medication) statically analyzed by one way ANOVA followed by Regression analysis.

This was further underscored by the statistically significant differences (p <0.001) observed in the means of diseases, comorbidities, and medications as confirmed by ANOVA, with an F value of 11.87.

**Table 3: ANOVA Analysis.**

| SUMMARY | | | | | | |
|---|---|---|---|---|---|---|
| *Groups* | *Count* | *Sum* | *Average* | *Variance* | | |
| No. Cases | 12 | 112 | 9.333333333 | 76.96969697 | | |
| No. of comorbidity | 12 | 31 | 2.583333333 | 10.26515152 | | |
| No of medication | 12 | 254 | 21.16666667 | 181.0606061 | | |
| ANOVA | | | | | | |
| *Source of Variation* | *SS* | *df* | *MS* | *F* | *P-value* | *F crit* |
| Between Groups | 2123.722222 | 2 | 1061.861111 | 11.87341522 | 0.0001 | 3.2849 |
| Within Groups | 2951.25 | 33 | 89.43181818 | | | |
| | | | | | | |
| Total | 5074.972222 | 35 | | | | |

**Table 4: Descriptive Analysis.**

| *No. Cases* | | *No. of comorbidity* | | *No of medication* | |
|---|---|---|---|---|---|
| | | | | | |
| Mean | 9.333333333 | Mean | 2.583333333 | Mean | 21.16666667 |
| Standard Error | 2.532615528 | Standard Error | 0.924894206 | Standard Error | 3.884376892 |
| Median | 5 | Median | 1 | Median | 17.5 |
| Mode | 3 | Mode | 1 | Mode | 7 |
| Standard Deviation | 8.773237542 | Standard Deviation | 3.203927514 | Standard Deviation | 13.45587627 |
| Sample Variance | 76.96969697 | Sample Variance | 10.26515152 | Sample Variance | 181.0606061 |
| Kurtosis | 0.45715097 | Kurtosis | 1.232544001 | Kurtosis | -0.736543408 |
| Skewness | 1.223728748 | Skewness | 1.568969163 | Skewness | 0.701567156 |
| Range | 26 | Range | 9 | Range | 38 |
| Minimum | 2 | Minimum | 0 | Minimum | 7 |
| Maximum | 28 | Maximum | 9 | Maximum | 45 |
| Sum | 112 | Sum | 31 | Sum | 254 |
| Count | 12 | Count | 12 | Count | 12 |
| Confidence Level(95.0% | 5.574249194 | Confidence Level(95.0%) | 2.035678423 | Confidence Level(95.0%) | 8.549455895 |

**Table 5: Correlation Analysis.**

| | *No. Cases* | *No. of comorbidity* | *No of medication* |
|---|---|---|---|
| No. Cases | 1 | | |
| No. of comorbidity | 0.991624682 | 1 | |
| No of medication | 0.982648312 | 0.961153852 | 1 |

**Table 6: Regression Analysis and Summary Output.**

Regression anlysis

SUMMARY OUTPUT

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.96759335 |
| R Square | 0.936236891 |
| Adjusted R Square | 0.922067311 |
| Standard Error | 2.449174443 |
| Observations | 12 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 2 | 792.6805676 | 396.3402838 | 66.07372 | 4.1741E-06 |
| Residual | 9 | 53.98609909 | 5.998455454 | | |
| Total | 11 | 846.6666667 | | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *Lower 95.0%* | *Upper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Intercept | 0.552353999 | 1.380691169 | 0.400056154 | 0.698444 | -2.57098642 | 3.675694417 | -2.57098642 | 3.675694417 |
| No. of comorbidity | 2.200392888 | 0.30897766 | 7.121527464 | 5.54E-05 | 1.501436862 | 2.899348914 | 1.501436862 | 2.899348914 |
| No of medication | 0.146297529 | 0.073569495 | 1.988562366 | 0.077977 | -0.02012823 | 0.31272329 | -0.02012823 | 0.31272329 |

PROBABILITY OUTPUT

| *Percentile* | *No. Cases* |
|---|---|
| 4.166666667 | 2 |
| 12.5 | 2 |
| 20.83333333 | 3 |
| 29.16666667 | 3 |
| 37.5 | 3 |
| 45.83333333 | 5 |
| 54.16666667 | 5 |
| 62.5 | 10 |
| 70.83333333 | 13 |
| 79.16666667 | 15 |
| 87.5 | 23 |
| 95.83333333 | 28 |

**Table 7: Probability Output.**

PROBABILITY OUTPUT

| *Percentile* | *No. Cases* |
|---|---|
| 4.166666667 | 2 |
| 12.5 | 2 |
| 20.83333333 | 3 |
| 29.16666667 | 3 |
| 37.5 | 3 |
| 45.83333333 | 5 |
| 54.16666667 | 5 |
| 62.5 | 10 |
| 70.83333333 | 13 |
| 79.16666667 | 15 |
| 87.5 | 23 |
| 95.83333333 | 28 |

Furthermore, a regression analysis was conducted to predict the number of diseases based on the number of comorbidities and medications, revealing a strong predictive model with R- a squared value of 0.936, indicating approximately 93.6% of the variance in the number of diseases can be explained by these two variables. Specifically, the number of comorbidities showed a significant positive relationship (p= 0.0001) with the number of diseases, with a coefficient of 2.20, suggesting that for each additional comorbidity, the number of diseases increase by approximately 2.2. The number of medications also demonstrated a positive relationship, though less pronounced (p= 0.078), with a coefficient of 0.146, indicating that each additional medication is associated with a 0.146 increase in the number of diseases. The overall model was highly significant (p< 0.00010 with an F- statistic of 66.07. These findings highlight the clinical complexity of managing patients with multiple health conditions, evidenced by the high medication burden and its considerable variance (181.06), which raises concerns about potential drug interactions, adverse effects, and adherence challenges. The observed data, when cross-referenced with the raw data (Table 2), demonstrates that high medication counts for diseases like dengue and acute febrile illness, combined with the high comorbidity counts for acute febrile illness and Lower respiratory Tract Infection, directly reflect and support the statistical analysis result. This underscores the need for integrated and Coordinated care, encompassing multidisciplinary teams, comprehensive medication reviews, and personalized treatment plans to optimize patient outcomes. Further research should focus on exploring the specific factors contributing to the high medication burden, the impact of comorbidities on disease outcomes, and the effectiveness of different care models to improve patient safety and quality of care.

**3. Pediatric Medication Usage: Fixed-Dose Combinations vs. Single-Dose Drugs**

As a researcher examining medication utilization patterns (Table.3) in Navi Mumbai, Maharashtra, India, the data presented reveals several key interpretations. Utilization of Single Dose medications (approximately 72.55%) and Fixed Dose Combinations (FDCs) (approximately 27.45%). The high frequencies observed for paracetamol and Ondansetron strongly suggest significant prevalence of conditions requiring symptomatic relief such as fever pain, and nausea within the studied population. This point is towards the potential burden of common ailments, possibly including viral infections or gastrointestinal disturbances. Furthermore, the substantial usage of antibiotics, notably ceftriaxone, Azithromycin, and Amoxicillin+ Clavulanic acid indicates a considerable presence of bacterial infections. This necessitates a closer examination of local infection rates and antibiotic prescribing practices to ensure responsible antimicrobial stewardship and mitigate the risk of resistance. The observed utilization of respiratory medication, including Levo salbutamol and Ipratropium bromide + Levo salbutamol, suggest a noteworthy prevalence of respiratory conditions, potentially linked to environmental factors such as air pollution, which is a common concern in urban areas.

The presence of 27.45 % of fixed dose combinations (FDCs) in the data set highlights the potential for simplified dosing and improved patient adherence. However, the inclusion of antibiotic-containing FDCs requires careful consideration to prevent inappropriate antibiotic use. The frequent use of Lactobacillus rhamnosus and zinc Acetate indicates the management of gastrointestinal issues, potentially related to diarrhea or nutritional deficiencies. The presence of medications like Dicyclomine+ Simethicone and Simethicone further supports this observation.

**Table 8: Fixed dose and Single Dose combination with their frequencies.**

| Fixed-Dose Combination | Number of times used | Single Dose | Number of times used |
|---|---|---|---|
| Clotrimazole, + Beclomethasone Dipropionate + Neomycin S | 6 | Ceftriaxone | 37 |
| Cefoperazone + Sulbactam | 4 | Metronidazole | 15 |
| Chlorpheniramine Dextromethorphan, Phenylephrine | 6 | Pantoprazole | 92 |
| Clavulanic Acid + Amoxicillin | 13 | Ondansetron | 98 |
| Ipratropium Bromide + Levosalbutamol | 16 | Paracetamol | 98 |
| Ciprofloxacin + Dexamethasone | 3 | Zinc Powder | 5 |
| Dicyclomine + Simethicone | 9 | Isolyte P | 4 |
| Levosalbutamol Budesonide | 2 | Ciprofloxacin | 1 |
| Ambroxol, Guaifenesin, Terbutaline | 3 | Lactobacillus Rhamnosus | 42 |
| Ambroxol + Salbutamol Albuterol | 4 | Zinc Acetate | |
| Folic Acid + Methylcobalamin | 1 | Levosalbutamol | 41 |
| Magaldrate+Simethicone Oxetacaine | 1 | Diclofenac | 10 |
| Calcium Phosphate + Magnesium + Zinc+ Vit D3 | 7 | Cefoperazone | 10 |

| | | | |
|---|---|---|---|
| Ceftriaxone + Tazobactam | 5 | Calcium Gluconate | 4 |
| Ambroxol + Levosalbutamol + Guaifenesin | 2 | Phytonadione | 2 |
| Piperacillin + Tazobactam | 1 | Oseltamivir | 15 |
| Paradichlorobenzene + Benzocaine + Chlorbutol + Turpentine Oil | 1 | Hydrocortisone | 5 |
| Xylometazoline Hcl + Sorbitol | 1 | Oxetacaine | 4 |
| Chlorpheniramine + Levodropropizine | 1 | Glycerine | 5 |
| Phenylephrine + Chlorpheniramine Maleate Dextromethorphan Hydrobromide | 5 | Cholecalciferol | 14 |
| | | Acetaminophen | 18 |
| | | Lactic & bacillus | 2 |
| | | Azithromycin | 9 |
| | | Phenytoin | 2 |
| | | Levetiracetam | 2 |
| | | Valproic acid | 4 |
| | | Cephalosporin | 3 |
| | | Warfarin | 1 |
| | | Calamine | 1 |
| | | Cetirizine | 13 |
| | | Clobazam | 7 |
| | | Simethicone | 8 |
| | | Amikacin | 4 |
| | | Lansoprazole | 1 |
| | | Influenza Vaccine | 1 |
| | | Hydroxyzine HCl | 1 |
| | | Methylprednisolone acetate | 2 |
| | | Fexofenadine HCl | 3 |
| | | Secukinumab | 1 |

**4. Commonly Utilized Drugs in the Treatment of Diseases**

The analysis of drug administration routes revealed that intravenous (IV) administration was the most frequently employed route, followed by oral, nasal, and topical routes. Among the drugs listed (Table.4), IV administration accounted for approximately 56.50%, oral administration for 29 % %, nasal administration for 0.70%, rectal administration for 0.70%, Inhalation administration for 3.60%, and topical administration for 6.50%. The dominance of IV administration highlights the acute nature of the conditions treated, necessitating rapid therapeutic action.

In case of a Lower Respiratory Tract infection, the most commonly prescribed drug class of drugs included Cephalosporin antibiotic (IV) and anticholinergic Bronchodilator (Inhalation). This drug was often administered in combination with pantoprazole (IV) for gastric protection and Paracetamol (IV) for fever management.

Long-term use of a Proton pump inhibitor may reduce the absorption of cephalosporins that require an acidic environment for absorption, leading to reduced efficacy of the antibiotic, and increased risk of infection.

For Acute Febrile Illness, the frequently used drugs were ceftriaxone (IV), Paracetamol (IV), pantoprazole (IV), and oseltamivir (oral). These were often co-administered with ondansetron (IV) to manage nausea. The prolonged use of macrolides inhibits the CYP450 enzyme in the liver, which may lead to corticosteroid, increasing the risk of steroid side effects (Immunosuppression, hyperglycemia, or fluid retention), increased corticosteroid level, prolonged OT interval, increased risk of arrhythmias.

Many times, patients complain about not getting the effect, it may be due to the coadministration of Beta-lactamase inhibitors and mineral supplements, which decreases antibiotic absorption.

These ADRs are rare, they can occur when these drug classes are co-administered. It is crucial to consider individual patient factors like existing medical conditions, comorbidities, and other medications before prescribing these drugs together. Always monitor for side effects and adjust doses if necessary. levels, prolonged QT interval, and increased risk of arrhythmias.

In Gastrointestinal Disease (Acute Gastroenteritis and gastritis), ORS (Oral Rehydration Solution) and Lactobacillus rhamnosus(oral) were the primary treatments. ORS and Lactobacillus rhamnosus were frequently combined to restore electrolyte balance and

gut flora.

In the treatment of dengue fever, electrolyte fluid therapy and crystalloid fluids are used to prevent dehydration and shock, with careful monitoring of fluid balance. Proton pump inhibitor (PPIs) like omeprazole may be given for gastritis or ulcers to protect the gastrointestinal tract, but long-term use can lead to electrolyte imbalance. For fever and pain, paracetamol is preferred over aspirin or NSAIDs due to the risk of bleeding. Close monitoring of electrolyte levels and kidney function is essential during this treatment.

In the management of febrile seizures. Key treatment focus on controlling the seizure, reducing fever, and maintaining hydration. Electrolyte fluid therapy is critical to prevent dehydration and correct imbalances that can worsen seizures. Benzodiazepines are essential for aborting seizures and preventing status epilepticus. Paracetamol is commonly used to reduce fever, a major trigger for febrile seizures. If gastrointestinal issues are present. Proton pump inhibitors may be prescribed to reduce Acid secretion, though they don't directly impact the seizure. Ondansetron can help manage nausea and vomiting associated with seizures or treatment.

**Table 9: List of drugs commonly used in the management of diseases.**

| Type of Disease | Generic Name | Class of Drugs | Brand Name | Route of Administration |
|---|---|---|---|---|
| Lower Respiratory Tract Infections | Dextrose & NaCl | Electrolyte fluid therapy | DNS | I.V |
| | Pantoprazole | Proton pump inhibitor | Pan | I.V |
| | Ondansetron | Serotonin 5-HT3 receptor antagonist | Emeset | I.V |
| | Paracetamol | Analgesic - Antipyretic | Neomol | I.V |
| | Ipratropium | Anticholinergic | Nebulizer Levolin | Inhalational |
| | Levosalbutamol | Broncodilator | | |
| | Ceftriaxone | Cephalosporin antibiotic | Ceftriaxone | I.V |
| Acute Febrile Illness | Dextrose & NaCl | Electrolyte fluid therapy | DNS | I.V |
| | Ceftriaxone | Cephalosporin antibiotic | Ceftriaxone | I.V |
| | Pantoprazole | Proton pump inhibitor | PAN | I.V |
| | Ondansetron | Serotonin 5-HT3 receptor antagonist | Emset | I.V |
| | Paracetamol | Analgesic - Antipyretic | Neomol | I.V |
| | Levosalbutamol | Broncodilator | Nebulizer Levolin | Nasal |
| | Ceftriaxone | Cephalosporin Antibiotic | Monocef | I.V |
| | Cefoperazone | Cephalosporin Antibiotic | Cefoperazone | I.V |
| | Lactobacillus rhamnosus | Prebiotic | Sporolac GG Sachet | Oral |
| | Dicyclomine, Paracetamol | Antispasmodic, Analgesic-Antipyretic | Syrup Cyclopam | Oral |
| | Aluminium Hydroxide, Magnesium Hydroxide & Oxetacaine | Antacids & Local Anaesthetics | Syrup Mucaingel | Oral |
| | Cetrizine | Antihistaminic | Syrup Cetzine | Oral |
| | Phenylephrine HCl & Chlorpheniramine maleate | Cough suppressant & Expectorant | Syrup Relent cold | Oral |
| | Xylometazoline HCl | Nasal Decongestant | Otrivin nose drops | Nasal |
| | Cefoperazone & Sulbactam | Cephalosporin, Beta-lactamase inhibitor | Cezosol | I.V |
| | Metronidazole | Nitroimidazole Antimicrobials | Metrogyl | I.V |
| | Oseltamivir | Neuraminidase inhibitor-Antivirals | Syrup Fluvir | Oral |

| | | | | |
|---|---|---|---|---|
| | Piperacillin & Tazobactam | Penicillin antibiotics, Beta-lactamase inhibitor | Piptaz | I.V |
| | Zinc powder | Mineral Supplement | Z & D drops | Topical |
| | Azithromycin | Macrolide antibiotic | Syrup Azee | Oral |
| | Prednisolone | Corticosteroid | Syrup Omnacortil forte | Oral |
| | Ambroxol, Guaphenesin & Terbutaline | Mucolytics, Expectorant & Bronchodilator | Syrup Bronkolyte | Oral |
| DIGESTIVE DISEASES | | | | |
| Acute Gasteroenteritis | Dextrose & NaCl | Electrolyte fluid therapy | DNS | I.V |
| | Pantoprazole | Proton pump inhibitor | PAN | I.V |
| | Ondansetron | Serotonin 5-HT3 receptor antagonist | Emeset | I.V |
| | Zinc powder | Mineral supplement | Z & D drops | Topical |
| | Lactobacillus rhamnosus | Prebiotics | Sporolac GG Sachet | Oral |
| | Oral Rehydration Solution | Electrolyte | ORS | Oral |
| | Beclomethasone, Clotrimazole, Neomycin | Topical steroids, Antifungals & Antibiotics | Siloderm mixi | Topical |
| | Metronidazole | Nitroimidazole - Antimicrobials | Metro | I.V |
| | Paracetamol | Analgesic - Antipyretic | PCM | I.V |
| | Levosalbutamol | Broncodilator | Levolin | Nasal |
| | Oseltamivir | Neuraminidase inhibitor | Fluvir | Oral |
| Gastritis | Dextrose & NaCl | Electrolyte fluid therapy | DNS | I.V |
| | Ceftriaxone | Cephalosporin antibiotic | Ceftriaxone | I.V |
| | Pantoprazole | Proton pump inhibitor | PAN | I.V |
| | Ondansetron | Serotonin 5-HT3 receptor antagonist | Emeset | I.V |
| | Paracetamol | Analgesic - Antipyretic | Neomol | I.V |
| | Azithromycin | Macrolide antibiotic | Syrup Azee | Oral |
| | Lactobacillus rhamnosus GG | Prebiotics | Sporolac GG Sachet | Oral |
| | Mecobalamin, Vitamin B6, Folic acid, Niacinamide, and Light Magnesium oxide. | Vitamin and Mineral Supplements | NBM | I.V |
| | Beclomethasone, Clotrimazole, Neomycin | Topical steroids, Antifungals & Antibiotics | Siloderm mixi | Topical |
| | Diclofenac | NSAIDS | Justin | Rectal |
| | Cefoperazone And Salbactum | Cephalosporin antibiotic-Beta lactamase inhibitor | Cezosol | I.V |
| | Amikacin | Aminoglycoside antibiotic | Amikacin | I.V |
| | Metronidazole | Nitroimidazole antimicrobials | Metronidazol | I.V |
| Dengue | Dextrose & NaCl | Electrolyte fluid therapy | DNS | I.V |

| | | | | |
|---|---|---|---|---|
| | NaCl | Crystalloid fluid | NS | I.V |
| | Pantoprazole | Proton pump inhibitor | PAN | I.V |
| | Paracetamol | Analgesic - Antipyretic | Neomol | I.V |
| | Ondansetron | Serotonin 5-HT3 receptor antagonist | Emeset | I.V |
| | Manganese, Selenium, Zinc, Molybdenum & Iodine | Mineral & Vitamin supplement | Syrup AtoZ | Oral |
| | Paracetamol | Analgesic - Antipyretic | Syrup Crocin | Oral |
| | Oral Rehydration Solution | Electrolyte | ORS | Oral |
| | Fexofenadine | Antihistamine | Syrup Allegra | Oral |
| | | | | |
| Febrile Seizures | Dextrose & NaCl | Electrolyte fluid tharepy | DNS | I.V |
| | Pantoprazole | Proton pump inhibitor | PAN | I.V |
| | Ondansetron | Serotonin 5-HT3 receptor antagonist | Emeset | I.V |
| | Paracetamol | Analgesic - Antipyretic | Neomol | I.V |
| | Clobazam | CNS Deppressant-Benzodiazepine | Tablet Frisium | Oral |
| | Levosalbutamol | Broncodilator | Levolin | Nasal |
| | Midazolam | CNS Deppressant-Benzodiazepine | Midaz | I.V |
| Bacillary Dysentry | Dextrose & NaCl | Electrolyte fluid therapy | DNS | I.V |
| | Ceftriaxone | Cephalosporin antibiotic | Monocef | I.V |
| | Metronidazole | Nitroimidazole antimicrobials | Metrogyl | I.V |
| | Pantoprazole | Proton pump inhibitor | PAN | I.V |
| | Ondansetron | Serotonin 5-HT3 receptor antagonist | Emeset | I.V |
| | Paracetamol | Analgesic - Antipyretic | Neomol | I.V |
| | Zinc powder | Mineral supplement | Z and D drops | Topical |
| | Lactobacillus rhamnosus | Prebiotics | Sporolac GG | Oral |
| | Oral Rehydration Solution | Electrolyte | ORS | Oral |
| | Cefotaxime | Cephalosporin antibiotic | Taxim | I.V |
| Neonatal Hyperbilirubinemia | Cholecalciferol | Vit D analog | Kidrich D3 drops | Topical |
| | Calcium | Calcium supplement | Calcimax | Oral |
| | Sodium Chloride | Crystalloid Fluid | NS | I.V |
| | Sodium, Potassium, Magnesium, Chloride, Hydrogen Phosphate Chloride, Acetate | Electrolyte | Isolyte P | I.V |
| | Zinc Powder | Mineral supplement | Z & D Drops | Topical |
| | Calcium Glubionate | Endothelin receptor antagonist | Syrup Calcionate | Oral |
| Urinary Tract Infection | Dextrose & NaCl | Electrolyte fluid therapy | DNS | I.V |
| | Pantoprazole | Proton pump inhibitor | PAN | I.V |
| | Paracetamol | Analgesic - Antipyretic | Aknil | I.V |
| | Cholecalciferol | Vit D analog | Kidrich D3 drops | Oral |
| | Ceftriaxone Sodium | Cephalosporin | Ceftriaxone | I.V |

| | | | | |
|---|---|---|---|---|
| | | antibiotic | | |
| | Calcium, Magnesium, Zinc, Vit D3 | Calcium & Phosphorus supplement | Calcimax P | Oral |
| | Cefotaxime | Cephalosporin antibiotic | Syrup TaximD forte | Oral |
| | Cefoperazone & Sulbactam | Cephalosporin antibiotic-Beta lactamase inhibitor | Czone+S | I.V |
| | Ondansetron | Serotonin 5-HT3 receptor antagonist | Emeset | I.V |
| | Paracetamol | Analgesic - Antipyretic | Neomol | I.V |
| | Ambroxol, Guaphenesin & Terbutaline | Mucolytics, Expectorant & Bronchodilator | Syrup Bronkolyte DX | Oral |
| Malaria | Dextrose & NaCl | Electrolyte fluid therapy | DNS | I.V |
| | Artesunate | Artemisin derivative | Falcigo | I.V |
| | Paracetamol | Analgesic - Antipyretic | Neomol | I.V |
| | Pantoprazole | Proton pump inhibitor | PAN | I.V |
| | Ondansetron | Serotonin 5-HT3 receptor antagonist | Emeset | I.V |
| | Primaquine | Aminoquinoline deivatives | Primaquine | Oral |
| | Ambroxol, Guaphenesin & Terbutaline | Mucolytics, Expectorant & Bronchodilator | Bronkolyte | Oral |
| | Cetrizine | Antihistaminic | Cetzine | Oral |
| | Levosalbutamol | Broncodilator | Nebulizer Levolin | Nasal |
| Euthermia | Dextrose | Electrolyte | D10% | I.V |
| | Amoxicillin & Clavulanate potassium | Penicillin antibiotic | Augmentin | I.V |
| | Lactose, Vegetable oil, Milk protein, Galacto-oligosaccharide, Fructo-oligosaccharide, Vitamins & Minerals, Fatty acids | Milk Formula and Cereals | Aptamil | Oral |
| | Calcium | Calcium supplement | Calcium | Oral |
| | Cholecalciferol | Vit D analogue | Vit D3 Drops | Topical |
| | Cefoperazone | Cephalosporin antibiotic | Cefoperazone | I.V |
| | Calcium Gluconate | Calcium supplement | Ca gluconate | I.V |
| | Domperidone | Dopamine Antagonist | Syrup Domastal | Oral |
| | Calcitriol & Calcium Citrate | Vit D analog and minerals | Syrup Gemcal | Oral |
| Pneumonia | Dextrose & NaCl | Electrolyte fluid therapy | DNS | I.V |
| | Pantoprazole | Proton pump inhibitor | PAN | I.V |
| | Ondansetron | Serotonin 5-HT3 receptor antagonist | Emeset | I.V |
| | Paracetamol | Analgesic - Antipyretic | Neomol | I.V |
| | Ceftriaxone | Cephalosporin Antibiotic | Monocef | I.V |
| | Oseltamivir | Neuraminidase inhibitor | Fluvir | Oral |
| | Azithromycin | Macrolide antibiotic | Syrup Azee | Oral |
| | Amoxicillin & | Penicillin antibiotic | Augmentin | I.V |

| | | | | |
|---|---|---|---|---|
| | Clavulanate potassium | | | |
| | Ceftriaxone | Cephalosporin Antibiotic | Maczone | I.V |
| Jaundice | Cholecalciferol | Vit D analogue | Kidrich D3 drops | Topical |
| | Calcium | calcium supplement | Syrup Calcium | Oral |
| | Sodium, Potassium, Magnesium, Chloride, Hydrogen Phosphate Chloride, Acetate | Electrolyte | Isolyte P | I.V |
| | Cefoperazone | Cephalosporin antibiotic | Cefoperazone | I.V |
| Tetany | Calcium and dextrose | Calcium Supplement | Calcium+D5% | I.V |
| | Dextrose & NaCl | Electrolyte fluid therapy | DNS | I.V |
| | Ondansetron | Serotonin 5-HT3 receptor antagonist | Emeset | I.V |
| | Pantoprazole | Proton pump inhibitor | PAN | I.V |
| | Phenylephrine HCl & Chlorpheniramine maleate, Dextromethorphan HCl | Cough and Cold Preparation | Syp XpectD | Oral |
| | Cholecalciferol granules | Vit D analog and minerals | Vit D3 sachet | Oral |
| | Calcium, Magnesium, Zinc, Vit D3 | Calcium & Phosphorus supplement | Syrup Calcimax P | Oral |
| | Paracetamol | Analgesic - Antipyretic | Neomol | I.V |
| | NaCl | Crystalloid fluid | NS Bolus | I.V |

Important medications are used to manage specific issues in treating various conditions. Calcium (calcium supplement), cholecalciferol (vitamin D analog), paracetamol (analgesic-antipyretic), and ceftriaxone (cephalosporin antibiotic) are frequently used for a variety of ailments. Ceftriaxone and Metronidazole (nitroimidazole antimicrobial) treat infection in bacillary dysentery, while zinc powder boosts immunity. Calcium and cholecalciferol support bone health in neonatal hyperbilirubinemia. Ceftriaxone treats urinary tract infections, while paracetamol relieves pain. Primaquine, aminoquinoline derivative, and artesunate, a derivative of artemisinin, are used as antimalarials for malaria, while paracetamol is used to treat fever. Ceftriaxone is used to treat pneumonia, while Oseltamivir (a neuraminidase inhibitor) and Azithromycin (a macrolide antibiotic) are used to treat respiratory infections and prevent viral infections. Cefoperazone, a cephalosporin antibiotic, treats potential infections in cases of jaundice, while calcium and cholecalciferol supplements promote good health.

## CONCLUSION

This study highlights the challenges of polypharmacy in pediatric patients, especially infants and young children. A strong correlation exists between diseases, comorbidities, and medication used, increasing treatment complexes. Therapeutic Drug Monitoring (TDM) helps maintain safe drug levels, reducing toxicity and failure. Personalized dosing through TDM optimizes medication used based on individual factors. AI and predictive modeling improve treatment safety by identifying potential drug interactions. Integrating TDM electronic health records (EHRs) allows real-time dose adjustments. AI-powered analytics helps optimize medication regimens and reduce risk. Data-driven decision support enhances prescribing accuracy and minimizes adverse effects. Research on polypharmacy can reduce unnecessary medications and improve adherence. Future studies should focus on optimizing pediatric pharmacotherapy for safer treatment.

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## REFERENCES

1. World Health Organization. World Health Day 2024. 2024.
2. Fraser LK, Gibson-Smith D, Jarvis S, Papworth A, Neefjes V, Hills M, Doran T, Taylor J. Polypharmacy in children and young people with life-limiting conditions from 2000 to 2015: A repeated cross-sectional study in England. J Pain Symptom Manag, 2022; 64(2): 213-221.
3. Jones M, Brown A, Green T, White C. Drug-drug interactions in polypharmacy. Drug Saf., 2021; 44(1): 45-56.

4. Johnson T, Smith L, Lee R, Patel A. Polypharmacy and hospitalization rates: A comprehensive study. BMJ., 2022; 378: 112-123.
5. K R A, Patil S, Rajpurohit P, Rokade N, Pawar K, Patil H. Exploring the complexity of polypharmacy: Methodology perspectives and patient-centric outcomes. Int J Res Anal Rev., 2024; 11.
6. O'Brien MJ, Pauls AM, Cates AM, Larson PD, Zorn AN. Psychotropic medication use and polypharmacy among children and adolescents initiating intensive behavioral therapy for severe challenging behavior. J Pediatr, 2024; 11405.
7. Horace AE, Ahmed F. Polypharmacy in pediatric patients and opportunities for pharmacists' involvement. Integr Pharm Res Pract., 2015; 4: 113-126.
8. Zanin A, Baratiri F, Roverato B, Mengato D. Polypharmacy in children with medical complexity: A cross-sectional study in a pediatric palliative care center. Children, 2024; 11(821).
9. Fraser LK, Gibson-Smith D, Jarvis S, Papworth A, Neefjes V, Hills M, Doran T, Taylor J. Polypharmacy in children and young people with life-limiting conditions from 2000 to 2015: A repeated cross-sectional study in England. Palliat Med., 2022; 64(3): 545-552.
10. Anju KR, Patil SD, Singh S, Gharat A, Katkar A, Pukale S. A retrospective cross-sectional study of prescription pattern in secondary care hospital in various departments. Int J Innov Res Technol, 2024; 10(12): 233-242.
11. Gingras M, Dubé R, Williams J, et al. Direct-to-consumer educational brochures to promote gabapentinoid deprescribing in older adults. JAMA Intern Med. Published online September 23, 2024.
12. Nishida S, Kato T, Hayashi Y, Yamada S, Fujii H, Yamada M, Asai N, Shimizu S, Niwa T, Iihara H, Kubota S. Effectiveness of countermeasure for polypharmacy by multidisciplinary team review in patients with diabetes mellitus. J Diabetes Investig, 2023; 14(10): 1202-1208.
13. Anju KR, Patil SD, Gharat S, Kakulte S, Kulkarni P, Kowale A, Chavan V. A retrospective study on drug utilization in pediatric patients. IJNRD Int J Novel Res Dev., 2024; 9(5): a556-a581.
14. Biradar SM, Vaishnavi KHBUK, SC BSSVM, Kalyane N. Assessment of drug utilization patterns in pediatric patients in comparison with WHO core indicators. GSC Biol Pharm Sci., 2019; 9(2): 84-92.
15. 9++Hoffman JM, Parker MJ. Electronic Health Records in Pediatric Studies: Challenges and Solutions. J Pediatr Health Care., 2020; 34(2): 185-192.
16. Miller AL, Schultze PM. Utilizing Electronic Health Records for Pediatric Data Analysis: Methodologies and Applications. J Med Inform, 2018; 16(3): 205-215.
17. Anju KR, Patil DS, Kulkarni P, Gharat S, Kakulate S, Kowale A, Chavan V. Assessing pediatric drug utilization pattern. Int J Creat Res Thoughts, 2024; 12(3): 1-12.
18. Streiner DL, Norman GR. Health Measurement Scales: A Practical Guide to Their Development and Use. Oxford University Press, 2015.
19. Field A. Discovering Statistics Using IBM SPSS Statistics. SAGE Publications, 2018.
20. Bland M. An Introduction to Medical Statistics. Oxford University Press.