

Alignment of a Child Malnourishment Clinic's Pharmaceutical Inventory with the WHO

Essential Medicines List for Children: A Case Study in Antigua, Guatemala

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Introduction

Malnutrition is a leading cause of morbidity and mortality in children under five, particularly in low- and middle-income countries (LMICs). In Guatemala, chronic malnutrition and stunting rates are among the highest in Latin America, disproportionately affecting rural and indigenous populations. Casa Jackson, a pediatric nutrition center in Antigua, Guatemala, serves as a frontline facility for treating malnutrition and related complications.

Access to essential medicines is a key component of successful malnutrition treatment, yet many small, non-profit clinics lack systematic pharmaceutical practices. The World Health Organization's Essential Medicines List for Children (EMLc) provides evidence-based guidance to ensure equitable access to life-saving medicines. This case study analyzes Casa Jackson's pharmaceutical inventory against the WHO EMLc to identify medication gaps, redundancies, and opportunities to optimize care delivery and minimize hospitalization duration.

Methods

The research aimed to evaluate the alignment of Casa Jackson Pediatric Nutrition Center's pharmaceutical inventory with the World Health Organization's Essential Medicines List for Children (EMLc, 2025 edition). The study used a case study approach to analyze the types and quantities of medications available, identify gaps relative to WHO recommendations, and assess operational challenges in pharmaceutical management within a low-resource setting.

The data collection process began with a comprehensive audit of the clinic's medication inventory. Each pharmaceutical item was cataloged by active ingredient, dosage form, strength, and therapeutic use. The baseline data had been initially compiled by a previous cohort of University of Texas at Austin interns and verified during the Summer 2025 research period. This ensured accuracy and continuity in evaluating changes in medication stock and availability over time.

Following the inventory audit, the list was compared to the WHO Essential Medicines List for Children (2023). Medications were coded into three groups: (1) those present in both Casa Jackson's inventory and the WHO EMLc (alignment), (2) those stocked by the clinic but not listed on the WHO EMLc (redundancy), and (3) those recommended by the WHO but not present in the clinic's inventory (gap). This comparison allowed for systematic identification of missing essential medicines and overrepresented non-essential items given Casa Jackson's malnourishment treatment plan for their patients.

Consultations were conducted with Casa Jackson nursing staff and administrators to understand medication use patterns, administration procedures, and stock management practices. These semi-structured discussions provided qualitative context to supplement quantitative findings from the inventory analysis. Staff insight clarified the practical challenges of medication acquisition and the effects of donation-based supply systems on consistency and patient care.

A descriptive comparative analysis was used to summarize the findings. Medicines were organized by therapeutic class, including antibiotics, anti-parasitics, antifungals, supplements, and emergency medicines. Ethical considerations were maintained throughout the study. The research did not involve human or animal subjects. All data was drawn from a general inventory list without identifiable patient information and voluntary staff interviews conducted with informed consent.

Results

A total of 463 medications listed on the World Health Organization Essential Medicines List for Children (EMLc, 10th edition, 2025) were analyzed against Casa Jackson's current pharmaceutical inventory. The findings revealed that Casa Jackson possessed 71 of the 463 listed medicines; approximately 15% overall alignment with the WHO recommendations.

Casa Jackson's inventory included several treatment categories essential for pediatric malnutrition treatment, such as antibiotics, antifungals, anti-parasitics, nutritional supplements, and anti-inflammatory drugs. However, many specialized or emergency medications were absent. The majority of stocked medications were oral solids or liquids, reflecting the clinic's outpatient and nutritional rehabilitation focus.

Antibiotics represented the strongest area of alignment. Casa Jackson carried broad-spectrum agents such as amoxicillin, azithromycin, cefixime, ciprofloxacin, metronidazole, and clarithromycin. However, injectable antibiotics and combination formulations for resistant infections were not in their inventory at the time of this study. This suggests adequate treatment for mild to moderate infections but not for severe pediatric infections.

Casa Jackson stocked nystatin and miconazole, providing medication for oral candidiasis and superficial fungal infections. The clinic also had albendazole and ivermectin, which provide some antiparasitic treatment. However, more specialized antiparasitic agents, such as praziquantel, mebendazole, and levamisole were missing, limiting treatment for less common parasitic diseases.

Nutritional supplementation was well supplied. The clinic consistently stocked vitamin A, riboflavin, thiamine, zinc sulfate, and multiple micronutrient powders, following WHO recommendations for nutrition. Oral rehydration salts were present but with limited stock, consistent with staff reports of intermittent availability. Iron-containing medications and folic acid were also stocked, providing essential support for anemic patients.

Casa Jackson had moderate levels of levothyroxine for hypothyroidism and omeprazole or esomeprazole for gastric protection. For respiratory medications, salbutamol and budesonide were available, aligning with WHO recommendations for pediatric asthma management. However, epinephrine injection and other asthma emergency medications were not stocked.

None of the WHO-recommended childhood vaccines were present in Casa Jackson's pharmaceutical inventory. Similarly, antiretrovirals, tuberculosis medications, and oncology treatments were not stocked, further emphasizing the clinic's specialized focus on malnutrition rather than infectious disease control or chronic disease management.

Analysis of medication recommendations indicated substantial overlap between the medicines available at Casa Jackson and those considered “essential” by WHO for malnourished pediatric populations. However, approximately 85% of EMLc-listed medicines were absent, underscoring significant supply gaps, particularly in acute care and emergency management categories. The majority of the clinic’s inventory falls within WHO-recommended categories but lacks comprehensive representation across all therapeutic classes.

Risk Factors

Environmental and socioeconomic conditions are the primary drivers of malnourishment prevalence. Meanwhile, multiple factors contribute to gaps in pharmaceutical access and management at Casa Jackson. The clinic’s dependence on donation-based medication is a primary determinant of stock variability and inconsistency. Donations often arrive without alignment to current patient needs or WHO EMLc priorities, leading to irregular availability of essential pediatric medicines and accumulation of redundant formulations.

Finances and the absence of structured procurement processes further contribute to these challenges. Without centralized oversight or standardized procedures, the clinic’s ability to anticipate medication shortages or expiration dates remains limited.

The absence of a formalized formulary or tracking system prevents systematic evaluation of medication relevance, frequency of use, or therapeutic outcomes. Together, these factors create conditions for understocking of critical medicines, overstocking of non-essential items, and interruptions in pediatric care continuity.

Health Outcomes

The observed pharmaceutical gaps have direct implications for pediatric health outcomes in Casa Jackson’s patient population. Limited access to oral rehydration solutions and zinc supplements can prolong diarrheal illness and dehydration, both of which are leading causes of morbidity and mortality in malnourished children. Inadequate antibiotic availability may also delay treatment for secondary infections, increasing the likelihood of hospitalization or extended recovery time.

Furthermore, the inconsistency of micronutrient formulations may influence progress in rehabilitation for children recovering from severe acute malnutrition. Similarly, redundancies such as multiple topical creams or adult-strength medications increase waste and reflect inefficiencies in stock utilization.

The absence of electronic tracking and structured formulary management affects medication safety and timeliness of care. Structured medication oversight, including formulary development and digital tracking systems, enhances both cost efficiency and patient outcomes by improving access to the most clinically efficient treatments. For Casa Jackson, the lack of such systems may emphasize inequities in care delivery and medication access among vulnerable pediatric populations.

Discussion

The analysis highlighted both alignment and deficiencies in stock, emphasizing critical shortages in oral rehydration solutions and pediatric formulations. In alignment with therapies needed for the population being treated. This case study reveals both progress and significant opportunities for improvement in Casa Jackson's pharmaceutical management practices. The presence of key medications, including antibiotics, antifungals, antiparasitics, and nutritional supplements, demonstrates commitment to evidence-based pediatric care. However, critical medication shortages and operational inefficiencies limit the clinic's ability to provide continuous and comprehensive treatment to children with malnutrition and related conditions.

The findings emphasize the importance of adopting structured formulary and inventory management frameworks to guide procurement decisions and reduce waste. In managed care systems, formulary management ensures that available medicines are evaluated for clinical value, safety, and cost-effectiveness, resulting in more rational use of limited resources. In low-resource clinics such as Casa Jackson, adapting these principles could help identify essential pediatric medications, streamline donation acceptance, and ensure consistent availability of high-priority treatments.

Evidence-based formulary development, when tailored to the needs of pediatric malnutrition settings, supports targeted procurement and enhances care continuity. Furthermore, highlights how data-driven medication oversight improves both resource utilization and clinical outcomes, principles that could be translated into simplified inventory practices within Casa Jackson.

The integration of digital or low-cost inventory tracking tools represents another actionable improvement. Even basic spreadsheet-based systems could enable staff to track stock levels, expiration dates, and usage trends, reducing the risk of shortages and overstocking. These interventions would align the clinic more closely with WHO recommendations and provide a replicable model for other donation-based facilities in Guatemala and similar low- and middle-income country contexts.

Ultimately, the observed gaps in medication availability highlight a broader issue of health equity. Ensuring consistent access to essential pediatric medicines is not only a matter of operational efficiency but a fundamental requirement for achieving equitable child health outcomes. Strengthening inventory systems and aligning formularies with WHO guidelines can improve rehabilitation outcomes, shorten hospitalization durations, and enhance the overall quality of care for vulnerable children in resource-limited environments.

Limitations

Casa Jackson is a small clinic with a narrow focus on treating malnourished children from across Guatemala, limiting the types and quantity of medications needed to treat their patients. While the WHO EMLc is meant to be available in functioning health systems, the focused scope of treatment of Casa Jackson does not make it completely applicable or appropriate for the age group and treatment plan of their patients. The clinic only had 30 patient beds, further constraining the amount of patients to be treated on-site. Casa Jackson is staffed by a professional medical and residential child-care team, including several volunteers, yet staffing shortages and seasons of heightened and lower volunteers heavily impact the efficiency of tending to all patient needs.

Next Steps

Future research should focus on developing and evaluating structured approaches to medication management within community and donation-based pediatric clinics. Establishing a standardized formulary system tailored to low-resource settings could help guide purchasing decisions and ensure that essential pediatric medicines are prioritized according to disease burden and clinical relevance. Applying evidence-based formulary strategies adapted from managed care frameworks could strengthen cost-effectiveness, minimize redundancy, and optimize therapeutic outcomes.

Implementing a digital or semi-digital inventory tracking system is another critical area for intervention. Data collection tools using spreadsheets could allow for real-time monitoring of stock levels, expiration dates, and usage patterns. Future studies could evaluate how digital inventory systems influence medication waste, supply consistency, and treatment outcomes for malnourished children.

Further research should also investigate the impact of inventory alignment on clinical outcomes, such as hospitalization duration, readmission rates, and recovery time in children with severe malnutrition. Establishing this evidence base could quantify the benefits of essential medicine alignment and justify funding for sustained pharmaceutical infrastructure improvements.

Collaboration with national and local public health agencies should be explored to integrate clinics like Casa Jackson into broader pharmaceutical policy frameworks. Creating partnerships between NGO-run centers, academic institutions, and pharmaceutical chains could enhance medication access and transparency, advancing progress toward equitable pediatric care in Guatemala and similar low- and middle-income countries.

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