CHAMPS

Case Study

Improving Child Survival Through Extemporaneous Pediatric Formulations: Lessons from Jaramogi Oginga Odinga Teaching and Referral Hospital in Kisumu County, Kenya.

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Summary

In Kenya, about 6,000 children are born with sickle cell disease (SCD), with about 50-80% dying before their fifth birthday due to inadequate access to timely diagnosis and treatment. In Kisumu County, Kenya, 21% of total live births are born with SCD.

Prior to implementing the Child Health and Mortality Prevention Surveillance data to action intervention, at Jaramogi Oginga Odinga Teaching and Referral Hospital (JOOTRH), hydroxyurea, a key treatment for SCD, was available only in adult formulations. Caregivers gave adult capsules on alternate days or two or three times a week to their pediatric patients, resulting in inconsistent dosing, poor adherence, and increased morbidity and mortality. Patients who could purchase hydroxyurea suspensions from external chemists did so to ensure rational use of the medication and improve clinical outcomes.

In response, JOOTRH's Pediatric Pharmacy Department, supported by CHAMPS, implemented an in-house extemporaneous compounding service to produce pediatric-friendly oral suspensions of hydroxyurea as well as other critical medications such as digoxin, furosemide, carvedilol, sildenafil, and levothyroxine. This intervention resulted in reduced hospital stays, lower costs, and improved clinical outcomes for patients who received the suspension consistently, based on observations from our routine monthly sickle cell clinics.

Recommendations to scale up this successful intervention include allocating a dedicated compounding room across all sickle cell clinics in Kenya. This will ensure availability of hydroxyurea in the right formulation, to the right patient, at the right dose and frequency. Regular training on extemporaneous compounding techniques to healthcare professionals and extending this service to other patient demographics such as geriatric patients, comatose adult patients, and patients on nasogastric tube feeding as needed have potential to improve patient health outcomes.

Background and context

Child Health and Mortality Prevention Surveillance (CHAMPS) aims to determine accurate causes of death in children under five years of age in regions where mortality is highest. The Data-to-action workstream of CHAMPS then institutes appropriate interventions to address these causes of death, in close collaboration with the ministry of health and other key stakeholders.

Sickle cell disease (SCD) represents a critical pediatric health challenge in Kenya. This genetic disorder causes red blood cells to become rigid and sickle-shaped, leading to blocked blood vessels and life-threatening complications. Nationally, about 6,000 children are born with sickle cell disease (SCD) each year, with approximately 50-80% dying before their fifth birthday due to inadequate access to timely diagnosis and treatment (1). In Kisumu County, CHAMPS data and other sources highlight SCD burden as particularly high, (1), with around 21% of infants born with the disease (1).

Hydroxyurea, which works by increasing the body's production of fetal hemoglobin (the type of hemoglobin that doesn't cause sickling) to prevent red blood cells from becoming rigid and sickle-shaped, is a cornerstone for managing SCD (2). However, it was only available in an adult capsule formulation countrywide. This presented a challenge in pediatric care, especially for infants and young children requiring precise doses other than the 250mg or 500mg capsule formulations. Even for children who are able to swallow and who receive doses between 250 - 500mg or above 500mg, suspensions help with dose precision and increased bioavailability. The CHAMPS findings showed increased morbidity and mortality due to poorly managed sickle cell patients, following -

which the Pharmacy team at JOOTRH submitted a grant proposal under CHAMPS data-to-action for seed money to establish an extemporaneous compounding service at the OBAMA Children's Hospital, the pediatric arm of JOOTRH. The goal of this service was to ensure the production and availability of accessible, affordable, and safe essential medicines for children with SCD and other chronic conditions within the facility.

Intervention

Utilizing the CHAMPS data-to-action seed grant, in January 2024, JOOTRH launched an extemporaneous compounding service (See Figure 1) in the Pediatric Clinical Pharmacy Department. The service focused on medications for conditions requiring specialized oral suspensions such as:

- Sickle Cell Anemia – Hydroxyurea
- Congestive Heart Failure – Digoxin, Furosemide, Carvedilol
- Pulmonary Hypertension – Sildenafil
- Congenital Hypothyroidism – Levothyroxine

Key inputs included:

- Digital weighing balances
- Mortars and Pestles (2 sets)
- Measuring cylinders
- Stirring rods
- Amber-colored stock and dispensing bottles (100ml)
- Sweeteners and suspending agents
- Nitrile-free gloves
- Customized labels

The service enabled pharmacists to prepare accurate dosages tailored to children's body weights and clinical needs, eliminating reliance on adult formulations or unregulated chemist supplies.

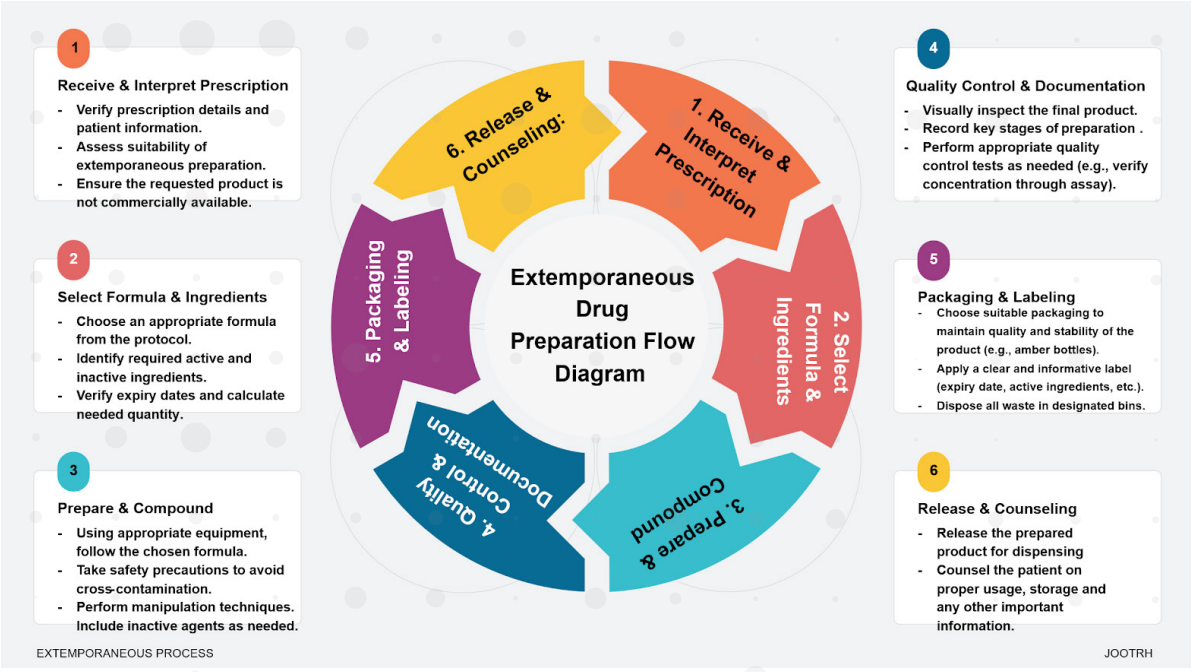

Figure 1. Extemporaneous Drug Preparation Flow Chart at JOOTRH

Impact of interventions

Since its implementation, the extemporaneous compounding service has yielded multiple benefits detailed below. Impact was measured through hospitalization records, pharmacy dispensing logs, informal caregiver feedback, and cost comparison analyses.

Impact of the intervention:

- **Reduced hospital stays,** as medications are administered on-site in correct dosages.
- **Lower treatment costs** by eliminating the need to purchase external medications.
- **Improved caregiver adherence** due to ease of administration and clearer instructions.
- **Fewer referrals** and follow-up complications.
- **Overall improvement in quality of life for children**

Results were disseminated to stakeholders, including the Pharmaceutical Society of Kenya, North Nyanza Branch; Kisumu and Siaya Counties; and the JOOTRH Pediatric and Pharmacy team in 2024.

Lessons learned

Successes:

- Compounded formulations enhanced dosing accuracy
- Clinicians appreciated the streamlined access to medications
- Caregivers expressed high satisfaction and adherence

Challenges:

- Limited space and equipment affected production scale
- Ongoing training needs for pharmacy staff

Recommendations for Expansion

To optimize and expand the impact of this service, the following steps are recommended:

1. **Extend the extemporaneous service** to all patient demographics beyond the borders of Kisumu County. This could be especially beneficial to:
   - **Comatose patients** (using NG tube-friendly liquid formulations)
   - **Geriatric patients** with swallowing difficulties
   - **Patients with compromised organs** (e.g., liver, kidneys) who require precise, often minimal dosages
2. **Provide regular training** on extemporaneous compounding techniques for healthcare professionals.
3. **Set up a dedicated room** within the hospital, equipped and staffed solely for extemporaneous preparations, to ensure quality, prevent contamination, and improve efficiency.

Conclusion

This initiative demonstrates how a relatively simple intervention—extemporaneous compounding—can fill critical gaps in pediatric care, especially in low-resource settings. Providing appropriately dosed medications improves outcomes and strengthens the overall healthcare system's response to chronic pediatric conditions like SCD.

By institutionalizing this service and expanding it across other facilities, the potential to reduce child mortality in Kenya and similar contexts is considerable.

References

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