



# The Impact of Surgical Interventions for Severe Typhoid on Families and Healthcare Systems in Rural South Central Niger



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# Background

- Average Nigerien female has almost 7 children (Fertility rate in 2021 was 6.8 – World Bank)
- Average Nigerien male has multiple wives leading to large family sizes
- Over half of the population of Niger makes less than \$2.15/day (Poverty headcount data at \$2.15/day based on prices at the time in 2017 was 50.9%)
- Majority of our patients come from rural villages in farming families without indoor plumbing or usage of latrines
- Transport to major health centers is mostly dependent on motorcycle or car taxi services



# Study Details

- We retrospectively reviewed medical records for children (ages 3 to 17) who had an initial operative intervention for typhoid intestinal perforations (TIP) in 2022 and those who needed an ostomy reversal from January 2022 to November 2023 at our hospital
- All cases of trauma were excluded
- No blood cultures or other laboratory tests are available at our hospital to diagnose if a patient has *S. typhi* infection preoperatively
- 190 children met inclusion criteria for the review

# Impact of Typhoid on Families: Mortality

Type of Surgical Intervention	Number of Patients	Mortalities	Mortality Rate
Primary Repair or Resection and Anastomosis	84	5	6%
Ostomy	106	22	21%
All Operative Interventions	190	27	14%

# Cost to the Patient – Hospital Bill

Type of Surgical Intervention	Average LOS	Average Actual Cost at Hôpital de la SIM Galmi (Age under 14)	Average Actual Cost of Surgery at Government Hospital (Hôpital National de Zinder and Centre Hospitalier Régional de Maradi in)	Average Number of Clinic Visits (Estimates)
Primary Repair	7 days (estimate)	127, 500 cfa (\$206 USD) – Age 5 - 14 157, 500 cfa (\$254 USD) – Age >14	167, 500 ± 55, 500 cfa (\$270 USD)	2
Ostomy (N = 106)	12 days (N=105)	184, 308 cfa (\$297 USD) (N =73)	239, 000 ± 55, 500 cfa (\$385 USD)	5

Calculations Based on November 2023 exchange rate: 620 cfa/USD

*Adamou H et al. Le fardeau de la perforation typhique de l'intestin grêle au Niger. J Sah sci santé (2021), vol 001 (2) :131-139*

# Patient Stories



# Ostomy



- 56% of patients needed an ostomy because of the severity of TIP
- 98% of patients (excluding inpatient deaths) had ostomy reversal by November 2023 (N =2 without documentation of reversal at our center)
- Average duration of the ostomy = 154 days (5 months) with range of 42 days (1.3 months) – 289 days (9.5 months) (even though protocol for reversal after 3 months)
- Barriers to timely reversal included: Lack of finances for paying the original hospital bill, lack of funds for transport costs, and illness in other family members
- Our hospital generously provides free of charge the surgery to reverse the ostomy when indicated, but families have other expenses specific to ostomy care

Average Time before Reversal (N = 82)	Average Number of Clinic Visits (Estimation)	Cost of Clinic Visit Bill (Estimation)	Average Cost of Transport to and from the Clinic with a Parent (N = 69 )	Total Average Additional Costs to the Family for Ostomy Care before Reversal
154 days	5	3, 000 cfa (\$4.80 USD)	7, 070 cfa (\$11.40 USD)	50, 350 cfa (\$81.20 USD)

# Impact of Typhoid on Healthcare Systems



- Nigerien government healthcare systems require upfront payment and supplies before services can be rendered
- Our hospital is able to provide emergent supplies and services for patients and flexible in timing of payment with most patients paying their final hospital bill before their first clinic appointment
- Yet, some can be greatly delayed on their first clinic follow up because of their need to still pay



# Cost to the Hospital

	Primary Repair (Estimation based on 7 day LOS; no Severe Acute Malnutrition (SAM))	Ostomy Creation (Estimation based on average 12 days LOS; no SAM)
ER visit	9, 815 cfa (\$15.83 USD)	9, 815 cfa (\$15.83 USD)
Surgery – 1st *	36, 329 cfa (\$58.60 USD)	36, 474 cfa (\$58.83 USD)
Surgery – 2nd *	Second washout possible with high contamination 25, 849 cfa (\$41.69 USD)	Second washout possible with high contamination 25, 849 cfa (\$41.69 USD)
Pre operative and Post operative Care	53, 837 cfa (\$ 86.83 USD)	87, 912 cfa (\$143 USD)
Additional hospital operative expenses	7, 311.54 cfa (\$11.79 USD)	7, 311.54 cfa (\$11.79 USD)
Ostomy Reversal Surgery and Hospitalization **	None	34, 377 cfa (\$55.45 USD) (Surgery) + 31,327 cfa (\$ 50.53 USD) (Pre/Postop Care)
Total Costs***	133, 141.54 cfa (\$214.74 USD)	233, 066 cfa (\$375.91 USD)

\* no surgeon costs included (salary from donors); \*\*paid for by the hospital benevolent fund;

\*\*\* not including all shipping costs and taxes for materials and medications

# Impact on Providing Care for Other Patients

In September 2022 (all ages of patients):

- 36% of all major operative cases – related to typhoid
- 55% of all major cases (when excluding OB/GYN and orthopedic cases) – related to typhoid
- This leaves less operative time and resources to take care of patients with other diseases that need surgical intervention such as patients with cancer



# Socioeconomic Impact of Typhoid Intestinal Perforations vs. Typhoid Conjugate Vaccination (TCV)

	TIP needing an ostomy	TCV
Duration of Benefit of Treatment	Temporary as risk of re-exposure to <i>S. typhi</i> and re-perforation	Lifetime
Total Cost of Treatment	184, 308 cfa (\$297 USD) to 239, 000 ± 55, 500 cfa (\$385 USD)	120 cfa (\$0.19 USD)
Complications	Possible surgical site infection, wound dehiscence, ostomy dehiscence, ostomy ischemia, ostomy prolapse, intraabdominal infection, ECF, SBO, incisional hernia, severe sepsis, death	Possible injection site pain, injection site infection



# Conclusion

- Pediatric patients in rural Niger are suffering at alarming rates of TIP
- With high operative typhoid volumes post rainy season, it can be difficult to have operative time for elective and semi-urgent cases.
- The cost differences to families and healthcare systems are significant between surgical complications from severe typhoid vs. the TCV (120 cfa (\$0.19 USD)) thus highlighting its necessity in the country.



Thank you